ELECTRICAL REVIEW

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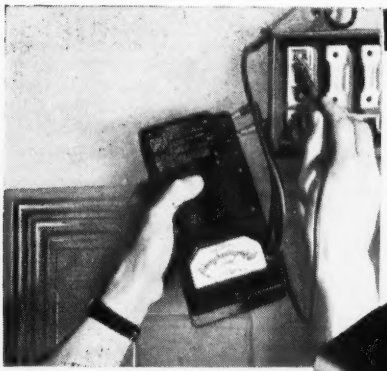

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ELECTRICAL REVIEW

8th MAY, 1953

THE OLDEST ELECTRICAL PAPER • ESTABLISHED 1872 • VOL. CLII • NO. 19

Friendly Criticism

BEFORE the war the average thermal efficiency of generation in Great Britain was somewhat higher than in the United States. Since then, however, the compelling need to obtain enough plant to meet the demand in the face of shortages of capital, material and labour has entailed retention of obsolete plant and reliance generally on quickly available proven designs for new or extended power stations. These difficulties have more than wiped out the former lead. American experience gained during the intervening period has been generously placed at the disposal of British engineers in the report (reviewed by us last week) of the American team, which visited this country last year. In return, certain methods obtaining here clearly impressed them. Many of the views expressed in the report are already familiar and generally in accord with those held here, but the bringing together and co-ordination of results obtained in practice gives a valuable perspective to modern trends.

The first most notable comment relates to the very much greater annual addition to generating capacity per head of population there, although the percentage increase in output is approximately the same. The position is even less favourable than the difference indicates, since the total time taken to put a power station into service is about twice as long here, largely because of the delays, the report notes, in obtaining statutory consents. An additional drawback is the tendency for some items to become obsolescent before use. Another criticism concerns the relatively small capacities of generating sets, with accompanying low steam temperatures, adopted in Great Britain which adversely affect initial costs and space required. The team's advocacy of a general adoption here of 150 to 200 MW reheat turbines with single pulverized fuel fired boilers seems questionable with the present usual local load densities, since failure of a set might entail too great a redistribution of power on the 132 kV grid. The completion of the 275 kV grid will,

however, materially alter the position. The crux of the situation seems to be one of reliability of boilers of over 1,000 k lb/hr having regard to the lower grades of coal necessarily used in power stations in this country. Many of the comparisons drawn between design features and methods of operation and maintenance in the two countries will be of immediate interest. Other recommendations indicate lines of sound engineering practice which we have no doubt will be given the consideration they merit as soon as circumstances permit.

HIGH-VOLTAGE CABLES

The impregnated pressure cable described in the I.E.E. paper reported in this issue is one of five types which have been highly successful in 132 kV operation. The question raised of whether one or other system could be standardized with a view to reducing production costs can be answered by referring to divers preferences of foreign buyers. As Great Britain is the largest cable exporting country in the world, that aspect has to be taken into account. The true answer, however, may prove to be related to the tendency towards higher voltages yet, and makers of all designs are confident of their ability to meet the conditions of the next stage. A degree of finality that would warrant any approach toward standardization still seems a long way ahead.

PLANT OVERHAUL

There is some force in the objection of the Electrical Trades Union to one of the recommendations of the American " productivity " team to the British electricity supply industry. It is the suggestion that there might be longer intervals between boiler inspections and overhauls of turbo-generators. The Union considers that indiscriminate lengthening of these intervals would introduce risks of danger to operatives. Inspection and overhaul regulations must pay some regard to the age of the plant. New boilers and turbo-generators may safely be left for longer periods but older equipment should be examined more frequently.

ENGINEERING WAGES

Less than six months after the award of increased wages to workers in the engineering industry their trade unions are putting in a claim for a further rise. Last time the demand for a £2 a week increase was met by an actual award of 7s 4d for adult male workers. Now an all-round increase of 15 per cent is proposed; the change in the nature of the claim from a definite sum to a proportional increase is said to result from the craft unions' desire to preserve the " differential " between skilled and unskilled men. As the percentage demanded works out at between 17s 6d and £1 a week and as the claimant present need is to keep down costs the proposal is not one likely to commend itself to the engineering employers, who are now feeling the effects of intensive competition in export markets. Since November, when the last increase in wages was granted, the cost of living has risen by only two points. Any further claim cannot therefore be justified on this basis and must be regarded merely as an attempt to regain part of what was " conceded " by the unions on the last occasion.

ELECTRICITY TARIFF HANDBOOK

Additions and amendments to the data given in the *Electricity Tariff Handbook* (Electrical Review Publications, Ltd., 7s 6d, plus 3d postage) are contained in a supplement now supplied with each copy and available free of charge to those who have purchased the book. Applications should be made to the Publisher, Dorset House, Stamford Street, London, S.E.1

Electric Melting Furnaces

Applications in the Iron and Steel Industry

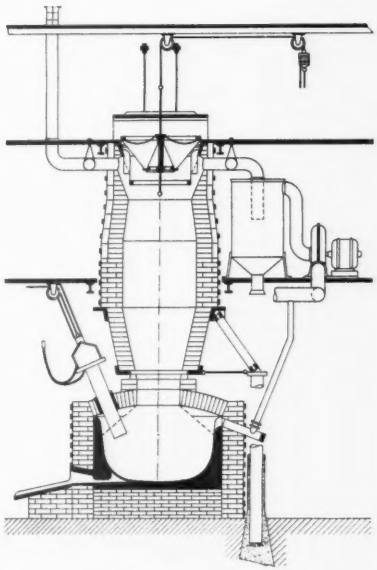
By ALAN J. BLACKWELL*

MOST electrical engineers are familiar with or have a full appreciation of the electrical principles of heating underlying the design and operation of electric furnaces, but only the comparatively few have a really good insight into the electrical applications to production of the furnaces, although such an insight is vital not only to the furnace electrical design, but also to the electrical operation and maintenance and, indeed, to high-quality production.

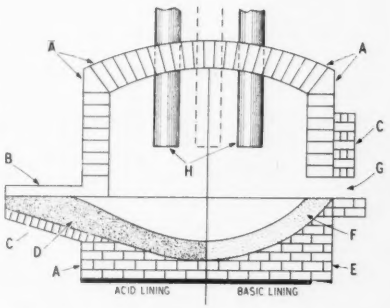
All furnace processes are concerned with the transfer of thermal units, and in the sequence of metallurgical operations it is logical to commence with an examination of the electric blast furnace.

The application of electrical energy for heating the blast furnace is not a general feature in industrial practice, largely because geographical situation and electricity supply availability are factors which determine whether or not such a proposition is practicable. While England is not very favourably situated for adopting the electric blast furnace, certain Continental countries can and do heat their blast furnaces electrically because they are equipped with the facilities necessary for success both from the economical and product quality points of view. For instance, Sweden has harnessed its river power to the production of electricity, and consequently at various seasons of the year there are available unlimited supplies of electricity for the production of high-grade pig iron.

The electric type of blast furnace differs slightly from the original equipment mainly because of the introduction of the six



Diagrammatic representation of Swedish electric arc blast furnace; loading 3,000 to 4,000 kW, three-phase



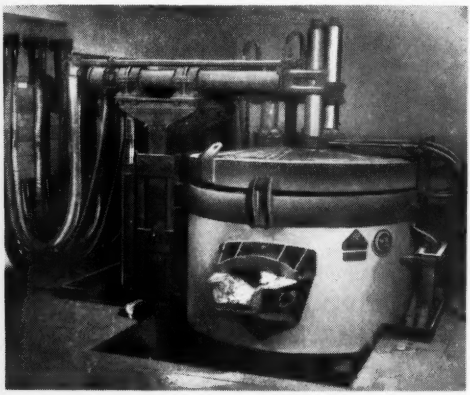
Depicting general construction of arc furnace for the production of high-grade electric steels and indicating alternative types of refractory linings: A, silica brick; B, tapping spout; C, fireclay brick; D, ground ganister; E, magnesite brick; F, ground dolomite or magnesite; G, charging door; H, electrodes

*Chief Metallurgist, Edward Pryor & Son, Ltd.

electrodes in the top of the bosh where the source of heat is generated by means of the electric arc and resistance heating. The furnace proper consists essentially of a tall circular shaft with the charging apparatus at the top. Here the iron ore, limestone and, in the case of Sweden, charcoal are intermittently mixed and charged into the furnace shaft. The internal structure of this shaft is so designed as to give what is termed the correct " batter " or incline of the furnace walls. Without this, the reduction or extraction of the metallic solution would not be effected. Four 3,000/4,000 kW electric blast furnaces operated by Uddeholm, Ltd., in Sweden, produce 30/40 tons of pig iron per day. The raw materials used for a ton of pig iron are: ore 1,750 kg; limestone 165 kg; charcoal 23 hl. Sweden is world famous for her high-quality iron ores, of which " magnetite " with an iron bearing content of roughly 75 per cent is outstandingly important, and this is reflected in the high reputation of Swedish firms for their tool steels.

From the economical point of view the electric blast furnace method is much more efficient than the conventional one using forced heated blast. The amount of charcoal used per ton of pig iron is much smaller in comparison with the amount of coke used in the ordinary method. The products of the electric blast furnace have greater purity and lower sulphur and phosphorus contents, and they are more consistently reproducible from both the chemical and physical aspects. The difference between charcoal/iron and coke/iron ratios has an important bearing in the number of heats per week available. With charcoal the burden of the blast furnace becomes less than when coke is used to extract the iron from the ore for forming CO and CO_2. All charcoal, even the best from coniferous woods, contains certain amounts of phosphorus, but the small amounts of charcoal used ensure that these non-metallic inclusions are reduced to a very small amount. To sum up, the electric furnace is to be preferred, as electricity is a source of energy which is clean and controllable compared with the gaseous fuels used in other furnaces.

The trend to-day is to use three electrodes in the electric arc furnace; three-ton equipment

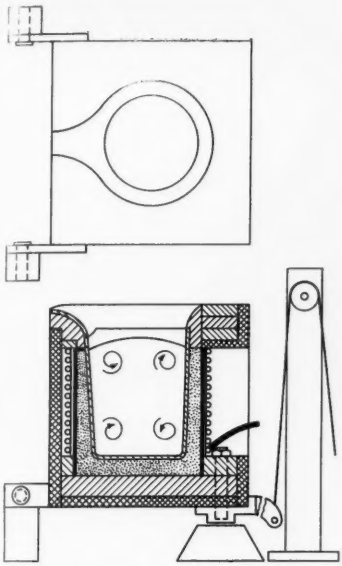


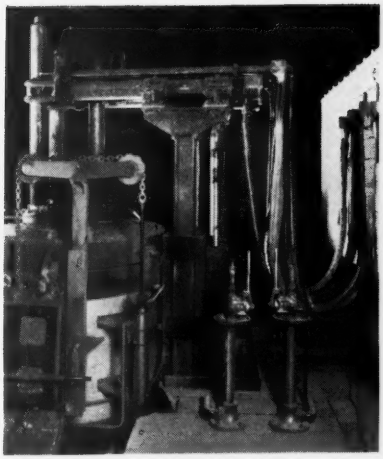
For the manufacture of steel two main types of electric furnace must be considered: the carbon electric arc furnace, and the high-frequency coreless induction furnace. There are modifications of these furnaces combining features of both, but they are nearly all experimental equipments used in research laboratories.

To-day's electric arc furnaces may vary in capacity from equipments designed to melt a few pounds to those capable of melting 30 tons. An accompanying illustration shows the general construction of an arc furnace and depicts alternative types of refractory linings which are employed to produce the high-grade electric steels, one half of the furnace dealing with linings adopted for the basic electric process, while the other half is related to the acid method of manufacture.

The main advantages of electric heating to the metallurgist are as follows: The heat available is " clean heat " which will afford high temperatures; the heat imput can be controlled to very small limits which ultimately means that the charge can be brought to and maintained at the desired temperature without incurring great losses; the " clean heat " ensures the absence of harmful effects on the melted metal, such as are encountered when melting with combustible gases; various types of high-grade steel are made available, such as alloy and carbon tool steels, high-speed tool steels, magnet steels, stainless and heat resisting steels, manganese steels and silicon steels.

Arc furnaces of up to 30 cwt capacity are usually charged by hand, and equipments of this and larger sizes are usually





Detailed electrode operating system of 3 ton arc furnace

Left: **Cross section of basic lined 10 cwt h.f. induction furnace**

designed so that the roof is made to swing outwards to enable the cold charge to be introduced from a collapsible bucket or skip equipment.

When the charge is completed all the furnace doors are closed and the transformer taps are set at the appropriate voltage. The three electrodes are then either lowered automatically or by hand until the arcs are struck. At the opening of a melt down there is usually quite an amount of surging due to the scrap being in the solid state, and consequently the electrodes tend to " bore " their way through the charge. The success of a melt down from the solid depends on getting a " little bath " as quickly as possible; this means that the electrodes will ride constantly and give an even output of heat which will of course be transferred to the surrounding solid material.

When the metal has completely melted, the slag is then made up according to the conditions required—oxidizing, reducing or neutral.

The main advantages of this over other types of melting are the flexibility of working, the melting and cleaning of the charge without the loss of valuable alloying elements, and the ability of these furnaces to produce first-class steels from relatively poor scrap.

The first arc furnaces to run on production lines had two electrodes with what is known as a conducting hearth. However, the trend to-day is to use three electrodes.

The electrodes are usually operated either manually by means of a hand wheel and winch, or automatically by the use of electric or hydraulic systems. The electric motors are controlled by suitable relays or electronic devices which are, in turn, controlled by the current flow through the cables to the electrodes. Hydraulic controls are based on the current flow in the electrode which is made to actuate the intermediate relays that operate valves in the electrode operating ram line. The manual method is always provided for and is called on when striking the arc and in the event of a breakdown of the automatic equipment. For normal working hand control can be rather costly both in respect of electrode wear and current consumption. Moreover, there can be serious drawbacks, especially if the electrodes are allowed to become immersed below the slag metal interface, as a spontaneous pick-up of carbon by the liquid steel from the electrodes might have an adverse effect on the working specification of the charge in the furnace. In the electric arc furnace a considerable amount of wastage very often occurred as

the result of " pencilling " of the electrodes and attempts were made to cure this by surrounding the electrodes with water cooled jackets at the point where they passed through the roof, and, from a practical point of view, sealing this area to stop the inrush of air. While the main objective in this connection has been achieved another undesirable feature has been brought about in its train by the fact that the readily oxidized parts of the metallic charge cannot easily escape from the slag surface. This has an effect of impeding the purification of the charge, so there is scope for improvement in this particular direction.

The induction furnace differs greatly from the arc furnace, particularly with regard to its limitations in the weight of the charge being melted and in the working of the bath to give the required chemical composition. The furnace proper is generally cylindrical and it derives its heat from a copper water cooled coil surrounding the circular linings. The heat is generated by high-frequency eddy currents induced in the work. Two of the chief advantages of the h.f. furnace are the speed of the melt down and the fine control of the bath temperature which can be as close as $\pm$ 5 deg C.

Both acid and basic linings can be used, but whereas the tendency is to work with basic linings in the case of the arc furnaces acid linings are to be preferred for working h.f. furnaces because the limitations of flexibility of working the heats demand material for melting of the highest quality.

One of the greatest assets of the h.f. furnace is its ability to mix the charge thoroughly at liquid temperatures as the result of the eddy currents actually imparting to the molten metal in the bath a continuous swirling motion. The h.f. furnace also produces high-grade tool steel and heat resisting, austenitic, stainless and alloy steels. In order to provide consistency both in chemical composition and physical properties, the material for use in the h.f. furnace must be very carefully chosen. One of the methods practised to-day is a process whereby both the arc and h.f. furnaces are used in sequence. In such a procedure a wider range of scrap can be used. The raw material is first melted down in the arc furnace and refined to a given specification. It is then cast into suitable shapes and sizes and afterwards used as a melting base for the h.f. furnace, and the final product shows both consistency and uniformity from successive heats. The melting technique of the h.f. furnace is somewhat limited in comparison with that of the arc furnace. Slags of varying compositions are used, but their flexibility is not ensured. There have been instances of arc furnace practice being adopted for h.f. furnaces, but the drawbacks appear to be in practical working issues, so that the general trend in connection with the h.f. furnace dwells upon the use of selected raw materials. Such policies pay in the long run both from the point of view of economics and quality control.

Acknowledgment is due to Uddeholm, Ltd., of Sweden, for permission to reprint the drawing of the electric blast furnace, and to Wild-Barfield Electric Furnaces, Ltd., for permission to reproduce other illustrations, including those of the arc furnace.

E.D.A. Sales Conference

THE 1953 Electricity Sales and Service Conference organized by the British Electrical Development Association will be held at Caxton Hall, Westminster, London, S.W.1, from 12th to 15th May. Dr. P. Dunsheath, president of the Association, will open the conference and take the chair at the first session. Chairmen of the other sessions will be Messrs. T. E. Daniel (N.E. Electricity Board), D. H. Kendon (Midlands Electricity Board), W. R. T. Skinner (S.E. Electricity Board) and J. Mould (East Midlands Electricity Board). Papers will be presented on " Load Factor Improvement," by Mr. W. Gilchrist (Merseyside & North Wales Electricity Board); " Basic Data in Commercial Development," by Mr. W. E. Swale (N.W. Electricity Board), Mr. J. M. Smillie (N.E. Electricity Board), and Mr. G. L. Tomlinson (Yorkshire Electricity Board); " Organization and Management of a Consumers' Repair and Maintenance Service," by Mr. A. O. Johnson (N.W. Electricity Board); " Recent Industrial Developments," by Mr. D. G. Gwyn (South Wales Electricity Board); " Electricity on Display," by Mr. N. F. Phillips (E.D.A.); and " Farm Electrification: A Review of the Present Position," by Mr. C. A. Cameron-Brown (British Electricity Authority).

On the third day a visit will be made to the Royal Festival Hall for a demonstration of the electronic organ and the colour change effects, and in the evening delegates will visit the Lighting Service Bureau to view Coronation decorations, when Mr. H. S. Hind will lecture on " The Presentation of 16 mm Films."

On the last day there will be a general discussion at the Café Royal, followed by the conference luncheon over which Mr. H. Nimmo (chairman of the Association) will preside.

British Plastics Convention

Points of Electrical Interest in the Papers

A PERUSAL of the papers which are to be read at the British Plastics Convention at Olympia, London, this year from Monday, 8th June, to Thursday, 18th June, in conjunction with the British Plastics Exhibition (organized by *British Plastics*), shows that directly and indirectly there is much of electrical interest in them, taking into consideration all the main electrical aspects, namely, the equipping and operation of electrically driven and electrically heated presses for producing all manner of plastics articles, the electrical properties of materials, and the production and use of electrical components and accessories.

Flow Properties

For instance, both the heating engineer and the electrical components designer must be concerned with the flow properties of plastics which are dealt with in the paper " Problems Related to the Manipulation of Unplasticized Polyvinyl Chloride " which is to be presented by J. J. P. Standinger at the morning session of the Convention on 9th June. The author shows that normally the flow properties in non-chlorinated vinyl polymers can be brought to the required level by raising the temperature, but in the case of chlorinated vinyl polymers their tendency to decompose or degrade at elevated temperatures imposes an upper limit, necessitating the maintenance of working temperatures well below the decomposition temperatures.

The present practice of adding stabilizers to raise the heat resistance, and of adding lubricants and/or plasticizers to improve the flow characteristics of the polymer is only an expedient, although a practical way of overcoming these deficiencies of the polymer. Conjecture and evidence point to the likelihood of producing a vinyl chloride polymer which flows readily over a not-too-narrow temperature range, possesses a satisfactory softening point, and has improved decomposition resistance at the working temperature.

In his paper " Industrial Applications of Unplasticized P.V.C." (Tuesday morning, 9th June), J. P. Byers says that recent applications which are showing particular promise include reflectors for fluorescent lighting fittings and linings for refrigerators.

In " Recent Commercial Development of Melamine and Guanamine Resins " (F. J. Mills, M.Sc., Ph.D., Tuesday afternoon, 9th June) the author says that at the present time a number of moulders are offering melamine mouldings to the electrical, hardware and light engineering trades, and that the " boil test," when intelligently applied, will no doubt result in the virtual elimination of faulty melamine mouldings. He also says that guanamine-based resins are now being developed for use as assistants to both melamine resins and urea resins, and that they may well become competitors of the melamines. At mines tend to be accepted as fortifiers for melamine and urea moulding powders, this stage of their development the guana- rather than as moulding powders in their own right.

Fibre Forming Polymers

In his paper " Moulded and Extended Polyamides and Polyesters " (Tuesday afternoon, 9th June) Dr. W. C. Fergusson says that the group of synthetic polymers described as polyamides and polyesters are best known as fibre forming polymers which are spun and highly oriented to produce the usable fibres. In recent years, this group of polymers has, in its turn, formed the basis of a new and rapidly growing family of plastics materials which is entering into all phases of industry. As a class, these new plastics show excellent mechanical properties, particularly high tensile and impact strength, abrasion, chemical and temperature resistance.

In general, the new family of plastics can be manipulated by the standard processes used for thermoplastic materials. Careful design of injection moulding and extrusion machines is required, together with close

temperature control and also a carefully controlled moisture and/or volatile content of the polymer to achieve the best results.

The applications of these new materials are described and examples are injection moulded gear wheels, lock-nuts, and mechanical goods. Extrusion grades are used for sheathing cables, for the production of strip for mechanical driving belts and for tubing. Polyethylene terephthalate is being extruded into film, which is being used for electrical purposes and has potentialities in packaging.

Surface Treatment

The use of silicones for the surface treatment of plastics electrical components to improve their insulation resistance and anti-tracking properties is receiving considerable attention, says J. H. E. Jeffes in his paper "Silicones in the Plastics Industry" to be presented on Tuesday afternoon, 9th June. He also shows that silicone bonded moulding powders have been developed from which high impact strength parts may be made which have the outstanding electrical and heat-resistant characteristics of these resins.

Reflections of the glass electrical insulator developments may be found in "Surface Chemistry and Adhesion of Glass and Plastics" by H. Cole (Wednesday morning, 10th June). It is shown that a soda-lime-silica glass consists essentially of a random array of electrically charged anions and cations, arranged to produce electrical neutrality in any region in the body of the material, but with a tendency towards a state of unsaturation at the surface. The residual surface forces are minimized by (*a*) the phenomenon of surface tension, (*b*) a surface accumulation of ions or molecules which decrease the surface tension, and (*c*) absorption and chemical combination with other molecules from the atmosphere. Glass surfaces are thus normally "hydrated" by reaction with water molecules.

Asbestos-Resin Combinations

P. H. H. Bishop, J. E. Gordon and P. L. McMullen deal with asbestos-resin combinations in which the asbestos acts as a reinforcing agent rather than as a simple filler, in their paper "Plastics Containing Asbestos as a Filler" (Wednesday morning, 10th June). They show that the mechanical properties of resin-asbestos compositions are negligible from the structural point of view when the asbestos is in the form of powder or very short fibre, but that they rise quite sharply as the fibre length increases. The authors refer to a commercially available product in which the reinforcement is chrysotile asbestos and the binder is a water-soluble phenol/formaldehyde resin and mention ways in which this material may be moulded, with special reference to the R.A.E. vacuum technique.

In "A Critical Survey of Commercial Low-Pressure Laminating Resins" (Wednesday morning, 10th June) V. E. Yarsley and A. G. Goodchild express the view that the next few years will see a considerable increase in the production of low-pressure laminating resins and of laminates made from them, and that it is desirable that a rational terminology shall be adopted for these materials very soon. Particular reference is made to the heat resistance of the low-pressure laminating resins, since this is the property in which such materials are found to compare least favourably with conventional construction materials.

Glass-Reinforced Plastics

Again points of special interest to the glass insulator makers and users are likely to be found in "Some Considerations in the Design and Manufacture of Structures in Glass-Reinforced Plastics" by G. C. Hulbert (Wednesday afternoon, 10th June). The author says that a major problem occurs when it is necessary to transmit loads from a glass laminate into a traditional structure, because of differing extensions under load of the metal and the plastics material. Intelligent design and the development of efficient adhesion methods can do much to help, but this difficulty will always limit the efficiency of plastics in an essentially composite structure.

Workshop requirements also need careful study in relation to the production quantities envisaged. Many of the techniques ideally suited to prototype construction are incapable of being extended beyond a limited output, while those most appropriate to the large production of small items entail capital expenditure which becomes prohibitive if the size of the product is increased. Each component and each production rate, therefore, requires individual treatment to achieve maximum efficiency.

In his paper "Some Problems Associated with the Design and Manufacture of Asbestos Reinforced Plastics Structures" (Wednesday afternoon, 10th June) D. S. Bancroft says it is usually found that the requirements given to the plastics engineer are not the fundamental requirements of the problem, and that at some later stage in the programme it is found that a more fundamental approach would have permitted a cheaper or otherwise better product to have been produced.

The author considers that by far the most difficult problem at the moment in the design and manufacture of the asbestos reinforced plastics structure is finding the real basic requirements of the job in hand. The best line of approach to enable the most efficient plastics structure to be produced then follows more readily and the most efficient method of fabrication can be chosen.

Durability

In their paper "The Durability of Plastics under Post Office Conditions" (Thursday morning, 11th June), A. D. W. Downes and A. A. New consider the failure of materials under Post Office conditions under three broad headings: (1) Those due to occasional shocks, principally mechanical; (2) those due to gradual wear of the materials; and (3) those due to gradual deterioration, or even merely alteration, of characteristics due to the ambient conditions. Many different mechanisms are responsible for the third class, such as the oxidation of materials by the action of atmospheric oxygen or ozone, deterioration by atmospheric sulphur dioxide or sulphuric acid, the depolymerization of certain compounds, the gradual flow of certain apparently hard plastics under mechanical stress, changes in mechanical and electrical properties caused by absorption of atmospheric moisture, and failure due to biological attack. In many cases plastics have advantages over the older materials under such conditions, but there is still room for improvement in plastics in some cases, particularly in their sometimes rather moderate mechanical properties.

In "The Durability of Adhesives for Wood" by R. A. G. Knight (Thursday afternoon, 11th June), a description is given of the Forest Products Research Laboratory's durability trials upon plywood and various built-up test units bonded with animal, casein and several types of synthetic resin glues. This material has been exposed in England and Nigeria for periods up to 10 years in normally heated buildings and unheated ventilated sheds, in fields open to the weather, in water, and in boats.

Independent work of a similar kind has been done in the other forest products laboratories of the Commonwealth and the United States, and so close has been the agreement between the stations that a jointly-prepared classification has been issued which provides for groups into which the different types of adhesives can be placed according to their durability. The groups are: weather-proof adhesives, moisture-resistant adhesives, moisture-resistant mould proof, moisture-resistant mould susceptible, and interior adhesives.

R. M. L. Baxter includes electrical applications among the uses for film in his paper "Merchandising of P.V.C. Film and Related Products" (Friday morning, 12th June). He says that the great possibilities of p.v.c. film can only be undertaken by maintaining a high standard of quality.

Paul Reilly gives a warning to the designers of plastics articles against endowing humble objects with fictitious grandeur in his paper "Design in Plastics—Whose Responsibility?" (Friday morning, 12th June).

In "A Study of the Problems Involved in High Quality Injection Moulding" (Monday afternoon, 15th June) E. Gaspar says that in cases of difficult mouldings the avoidance of moulding defects and internal stresses depends upon a delicate balance of cavity pressures and temperatures. These temperature and pressure variations are analysed and their importance stressed. It is suggested that this information should be available for every type of heating chamber. Further, it is emphasized that injection moulding has now become a science, and that the true appreciation of the factors influencing the quality of mouldings and production speed can be of great assistance to the moulder in the future, particularly with intricate mouldings and new materials.

Size of Mouldings

In "The Economics of Large Injection and Compression Moulding Machines" (Tuesday morning, 16th June) David Radford says that on the thermoplastic

side, it appears that about 120 oz may be the limit by methods understood to-day, bearing in mind that machines occupying 200 sq ft and costing probably £20,000 have only 3 lb shot weight capacity to-day. The output of large components, when moulded, is so high relative to the magnitude of the orders that one must question the economics of the tooling charges involved.

Although compression presses are in existence up to 2,000 tons, mouldings about 25in square are about the largest which can be produced if there is to be any appreciable depth, as in a television cabinet, for example, although within reason the weight of the component is unlimited. In this direction plant development is to-day very limited and the position appears to be much more stable.

Pre-heating or pre-plasticizing will add considerably to the size of mouldings, and in the case of injection moulding may even mean an increase of 100 per cent. The problem of heating is also discussed, and the necessity for obtaining a large mass of steady heat for long periods, rather than intermittent surges of high localized heat. The question of the higher pressures needed, the increased residual strains in mouldings, and the greater need for temperature control are other points referred to.

Telecommunication Plastics

R. C. Mildner, H. F. Wilson and E. I. Cooke say in their paper "Plastics in the Telecommunication Cable Field" (Wednesday morning, 17th June) that for land communication cables, paper/air dielectrics when kept dry have advantages over polythene and polystyrene in that they may possess lower permittivities. The latter thermoplastics have, however, other attractive features and in the hands of the cable maker they can be used to advantage so that an economic cable can be made. There will be an increased use of plastics telephone cables in the future.

The contribution of plastics to radio-frequency cables is universally recognized. The advanced development of radar in this country during the war proved to be a most powerful weapon, and the possession of robust, flexible, radio-frequency cables capable of carrying high power made an invaluable contribution to this development.

The cable maker is often forced to adapt his design to overcome the limitations of his raw materials and some of the solutions to these problems are discussed. These problems, it is said, may be concerned with deficiencies in the properties of the materials available, their uneconomic cost or the close dimensional manufacturing tolerances which are sometimes demanded.

The final paper of the Convention, "Flame-Proof Conveyor Belting" by S. J. Skinner (Wednesday afternoon, 17th June), deals mainly with the use of materials other than natural rubber for belting manufacture, and it is concluded that, given proper equipment, satisfactory belts can be made by using (1) polyvinyl chloride plasticized substantially with tricresyl phosphate, or (2) polyvinyl chloride plastics in which a proportion of plasticizer is replaced by a nitrile rubber.

Turkish Power Schemes

PLANS for providing an abundant supply of cheap electric power in Turkey envisage the construction of nineteen hydro-electric stations with an annual output of 2,000 million kWh. The first part of the programme includes twelve stations at present in process of construction which will produce 950 million kWh a year, and the Electrical Research Administration has announced that it is hoped to invite tenders for, and begin work on, four others during the current year. Details of these were given recently in the Turkish Press.

The first, the Gediz-Demirkopen barrage and hydro-electric scheme, will prevent flooding, irrigate 56,000 hectares, and make available 152 million kWh annually for distribution in Manisa, Akhisar, Turgutlu, Salihli and other cities. Another power development, on the Kizilirmak, at Koprukoy, 100 km from Ankara, will afford a supply of 400 million kWh a year to improve the supply to North-West Anatolia. The Akcay-Kemer scheme constitutes the key to the planning of the Menderes plain, providing flood protection for 38,000 hectares of land and supplying 145 million kWh a year. The power will be distributed to Nazilli, Aydin, Germencik and Soke, and the network will be connected at Torbali to that of Gediz. Lastly, an earth barrage 45 metres in height to be constructed on the Yesilirmak 25 km south of Niksar will make possible the irrigation of 30,000 hectares and prevent flooding, while the power plant will produce 200 million kWh a year.

United Kingdom firms interested in these projects can obtain further information from Elektrik Isleri Etüd Idaresi, Kazim Gökalp Caddesi No. 34, Yenisehir, Ankara. The Commercial Relations and Exports Department of the Board of Trade would like to be notified of any action taken.

VIEWS on the NEWS

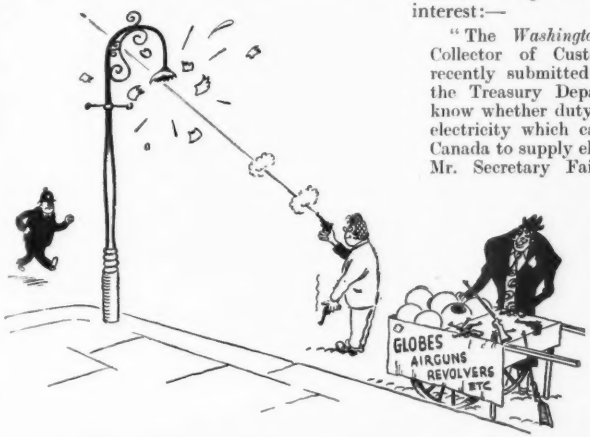
By REFLECTOR

READERS who have seen the Blue Ensign flown by a Post Office cable ship may have wondered what the crest was all about. A note from the Post Office explains it:—

"The crest, which was registered in 1883, represents Father Time seated on a coil of rope on the seashore watching the shore end of the first cable being landed. In his left hand is his scythe, and in his right his hour glass which is shown as being shattered by an electric spark. On his face is a look of astonishment, symbolical of his surprise at 'Time' being annihilated by the electric telegraph. The motto reads '*Ne tentes aut Perfice*' which, broadly interpreted, means 'If it's worth doing at all, it's worth doing well.'"

* * *

Electric street lamps are a regular target for irresponsible youths armed with stones, catapults, airguns and other weapons. It may have been a realization of this which led an American producer of weapons—Colt's Manufacturing Co., Hartford, Connecticut — to devise a "shatter-proof" globe. This is of a modified acrylic resin and will remain unbroken (it is claimed) even though drilled with bullets. (Nothing is said about the lamp inside the globe.) There should be interesting sales possibilities in this strange combination of products.



* * *

"In the small English town of Margate the gas jets continue to smoke dimly as they did a hundred years ago" said Moscow Radio recently. That is perhaps not quite fair, but it is true that Margate has not yet converted the whole of its street lighting to electricity. I do not know why the Russian broadcaster picked on Margate to compare it unfavourably with the mountain village of Delavoi, which has just built a hydro-electric station. Margate is by no means the worst-served town in the matter of street lighting.

* * *

With the growing interest in the international exchange of electric power the following ruling reported in the *Electrical Review* of 25th November, 1887, is of interest:—

"The *Washington Critic* says that the Collector of Customs at Eastport, Me., recently submitted an unusual question to the Treasury Department. He wanted to know whether duty was to be assessed upon electricity which came over the wires from Canada to supply electric light for Calais, Me. Mr. Secretary Fairchild has replied that electricity is an invisible subtle agent or power, without any substance as a mercantile commodity, and is not provided for in the tariff or liable to duty."

I hope that by reproducing this I am not putting ideas into the heads of any Customs authorities.

A "Flexible" Installation

The Liverpool Exchange Buildings Example

SITUATED on three sides of a quadrangle, which from time immemorial has been known as the "Exchange Flags," the new Liverpool Exchange Buildings now in course of erection are on a site which for over 745 years has been the hub of commercial activities in that city. They succeed five other buildings, the first of which, the Common Hall and Market, were constructed in 1207. Each was designed to provide for the commercial requirements of the various ages, but nevertheless it is certain that business had nearly always to be done in the open air, despite the uncertain climate.

The new buildings, however, will be adequate for their purposes and will incorporate improvements for the convenience and comfort of their tenants, who represent all the commercial and professional activities of the port. Rising 135ft in height, they have eleven floors above street level and two basement floors which, when completed, will comprise over nine acres of floor area.

The rebuilding, for which Messrs. Gunton and Gunton, the London architects, are responsible, is planned in six sections which are divided into two groups, Derby House and Sefton House. These sections have been built as corresponding sections of the old Exchange Buildings were demolished. Work started in 1937 and the first section of Derby House was completed before the outbreak of war, during the early part of which certain parts were occupied by the Admiralty and Air Ministry. Building operations ceased in 1940 but were recommenced in 1946. The second and third sections of Derby House are now finished

New Exchange Buildings, Liverpool, in course of construction, with part of the old building still to be demolished in the right foreground together with temporary offices. Provision has been made in the electrical installation for floodlights to illuminate the building when completed

and the first section of Sefton House is nearing completion.

Special regard is being paid to the electrical installation, which is being carried out by B. French, Ltd., Liverpool, to a scheme prepared by the General Electric Co., Ltd. Provision is being made not only for the initial load, but also for future extension and maintenance of the installation.

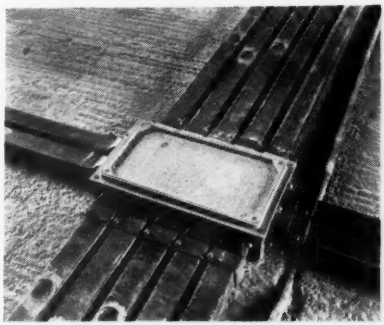
Many miles of G.E.C. 2in by 1½in underfloor rectangular steel duct, provided with outlet holes at 3ft centres, have been embedded in the floor fills throughout the buildings. From these outlets conduit extensions for supply circuits can be made by the use of a back outlet conduit box. All unused openings are sealed with pressed steel covers and in corridors, or where a cement screed is placed over the ducts, by bitumen. The advantage of the steel duct is that it provides a metal-sheathed earthed system which is permanent and mechanically strong enough to stand rough usage during building construction, is rigid and yet capable of being easily laid square to the building and true to floor levels.

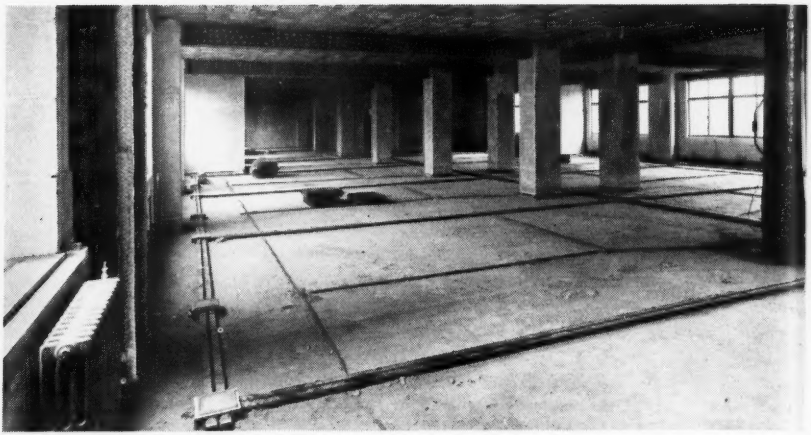
In the second section of Derby House rectangular ducts run on one side of the corridor. On the other side G.P.O. wood fibre conduits are used because of the post-war shortage of steel. The floor boxes of both systems are interconnected by two-way ducts. In later sections, however, both systems use one combined run having a common floor box. For these sections five ducts are employed in each corridor run, three for the landlords' and tenants' services and two for Post Office lines. The ducts are intersected at given points by 16in by 9in floor boxes containing cable separators arranged to take three one-way ducts and two one-way ducts on two sides and two one-way ducts on the opposite sides. From these corridor boxes, for which seven different aluminium trays and traps have been designed, two ducts are taken into tenants' premises where they are connected to a 9in by 9in tenants' box. This box, from which the tenants' later requirements (for lighting, heating, dictaphones, business machines, etc.) are supplied, is also equipped with specially designed separators to form a mechanical barrier between G.P.O. services and lighting and power circuits.

Conduit for the tenants' lighting system is so arranged that all wiring can be carried out within the area of a particular floor. This is done by fitting, at the most convenient duct outlet in an office area, a back outlet box from which a conduit is run across the floor to the switch position. Through-way switch boxes are employed and from these conduit is extended to the floor above and run to loop into pattern conduit boxes in the ceiling.

Typical corridor run of steel duct and branch ducts to office areas

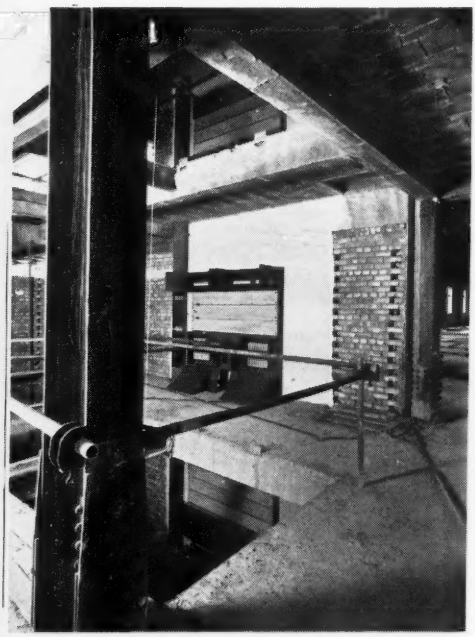
Five ducts in corridor run intersected by floor box containing cable separators, showing close-up of corridor box and duct connections





Typical duct installation in office areas

Four-bar totally enclosed copper rising main and meter link panels in Sefton House



In the first section of Sefton House, to avoid any interference with finished floors when completed, a 1in conduit has been taken from each outer corner of the floor boxes, in the outer office wall run, to an outlet box fitted to the skirting. Local telephone points can thus be established at the outlet box or extended from it along the skirting. If any tenant requires socket outlet points they can be provided also, either at the outlet position or elsewhere, by fixing a back outlet point over the flush conduit box and running conduit from it to the required positions. In the second section two single-way ducts which terminate in 4in by 4in conduit boxes are being provided at skirting level.

The underfloor duct system, which is interconnected to run throughout the entire Exchange Buildings, is fed from several rising mains through meter link panels on all floors. The panels in the section of the building now under construction have doubled the facilities allowed for on the panels installed in previous sections because experience has shown that in many cases socket outlets are required for small power and heating circuits. In addition some tenants require separate meters for lighting and power circuits, which has meant extra fuse ways and local circuits.

The meter link panels in this section are equipped with a 150 A s.p. and n. back-of-board switch; 36 single-phase fuses and links for meters; 60 15 A single-phase fuses and neutral links for sub-circuits; and

three hardwood panels for mounting 35 meters. Each panel is constructed on angle-iron framework for floor and wall fixing. In the section of the building now under construction, these panels are in corridor-level metering rooms, but in Derby House, where open aluminium busbars are employed, the metering rooms are situated on each half-landing.

A 500 A four-bar totally steel enclosed copper rising main serves all floors of Sefton House for tenants' lighting and power requirements. The riser, which receives its supply from the main intake chamber through a 500 A t.p. and n. busbar chamber in the basement meter room, begins in the first floor meter room and terminates near ceiling level on the ninth floor, the connection to the tenth floor passing through the ceiling. The rising main commences on the first floor because restricted space on the lower and ground floors due to the tenants' requirements prevents the employment of a straight run of rigid conductors.

For landlords' lighting and services in Sefton House, 4in by 4in sheet steel wiring trunking runs from the basement busbar chamber through all meter rooms, terminating on the tenth floor. Commencing on the first floor, busbar chambers, together with switchgear to feed local lighting and power fuse boards, are provided at each floor level. To feed each busbar chamber four 0·15in vulcanized rubber cables in the trunking are looped into the respective chambers. By this method, facilities have been provided at each floor for a selection of phase connections and also for any addition of three-phase power which may be required on the landlords' section. A pin rack at each floor level is used to take the vertical weight off the cables. To feed the rising main for the landlords' services a 0·15 by 3½in paper insulated lead covered cable has been run from the main intake room in the basement.

Underwater Impregnated Pressure Cable

THE first three-core 132 kV impregnated pressure cable in the Southern Hemisphere is now being laid in the outskirts of Sydney, Australia. The contract for supplying and laying the 10 miles of cable in two 5-mile circuits was awarded to British Insulated Callender's Cables, Ltd.

The work is being carried out for the Electricity Commission of New South Wales and involves the crossing of a tidal arm of the Parramatta River. This is being carried out with two 404 yd lengths of cable which have been specially constructed for underwater use.

The underwater cable, the first impregnated pressure cable to be laid under water, differs from the land cable to a relatively small degree. The 0·3 sq in screened circular copper conductors and the insulation and screening of the three cores are identical for the land and underwater types. The underwater cable has a slightly thicker sheath, 0·145in minimum as compared with 0·125in, is reinforced with tin-bronze strips and tapes instead of steel, and is armoured, whereas the land cable is not.

The reinforcement, which is used to enable the sheath to withstand an internal gas pressure of 200 lb/sq in, is of tin-bronze instead of steel, because it is less likely to corrode in the event of the outer protective covering being damaged. The main anti-corrosive protection applied over the reinforcement comprises one cotton tape, two self-sealing rubber tapes, a further cotton tape and three hessian tapes, being practically identical with the covering used on the land cable. The underwater cable is armoured with a single layer of 0·16in diameter galvanized steel wires, applied over the main anti-corrosive protection, and the armour is served overall with two layers of bitumen impregnated hessian tape. The diameter overall is 5·29in as compared with 4·59in for the unarmoured land cable; the weight is about 90 lb/yd as compared with 62 lb/yd for the land cable.

A gas channel pipe, with an internal diameter of 0·25in and an external diameter of 0·375in, is laid up in one of the filler spaces between the cores. After completion of laying, nitrogen gas is introduced into the cable, permeating the dielectric, at a pressure of 200 lb/sq in.

The two circuits are each capable of carrying a continuous load of 85 MVA, or if both circuits are loaded simultaneously, they can carry 77·5 MVA each. The underwater cables could carry even greater loads, but their ratings are controlled by the fact that their shore ends and the general run of the circuits are laid direct in the ground. The quoted ratings apply with a ground temperature of 20 deg C.

The two lengths of underwater cable were supplied on two drums each 12ft in diameter and 9ft 4in wide. The gross weight of each loaded drum was nearly 19 tons.

PERSONAL and SOCIAL

News of Men and Women of the Industry

THE Irish Government has appointed **Mr. J. P. Digby,** managing director of Pye, Ireland, Ltd., and **Mr. T. MacMahon,** former county surveyor, as members of the Electricity Supply Board for the next four years. Four other members, **Dr. T. A. McLaughlin, Mr. J. M. Fay, Dr. H. Kennedy** and **Mr. J. A. Ryan** have been reappointed for the same period and **Mr. R. F. Browne** continues as chairman.

The Metropolitan-Vickers Electrical Co., Ltd., announces that as from 30th April **Mr. J. I. Law-Brooks** has relinquished the duties of manager, London district office, but he will carry out certain special duties and remain available for consultation until the end of this year. **Mr. E. Mead,** B.Sc.(Eng.) Lond., M.I.E.E., has been appointed to succeed him as manager of the London district office. Mr. Mead obtained his early training at Brighton Technical College and joined the Metropolitan-Vickers Co. as a college apprentice in 1925. From 1926 to 1933 he specialized in heavy switchgear, spending a short time with Manchester Corporation Electricity Department and also handling contracts for Russia and for the Central Electricity Board's 132 kV South-West grid scheme. In 1933 he became manager of the Stoke-on-Trent sub-office, during which time he was chairman and treasurer of the North Staffordshire Branch of the Association of Mining Electrical and Mechanical Engineers. In 1944 Mr. Mead was transferred to London, where he has been actively concerned with the British Electricity Authority and Electricity Boards. He was appointed assistant manager, London office, in April, 1952.

Mr. E. Mead

Mr. J. T. Sharples, B.Sc.Tech., A.M.I.E.E., recently resigned his position as engineer-in-charge of the Heating Element Department, Metropolitan-Vickers Electrical Co., Ltd., to take up an appointment as district engineer and manager (northern counties) with Barlow-Whitney, Ltd. He will operate from their new address, 32, Deansgate, Manchester (telephone : Blackfriars 3851). Mr. Sharples received his technical education at Manchester University, taking an honours degree in electrical engineering, and spent twenty-one years on heating problems with his late company. Barlow-Whitney, Ltd., have terminated their agency arrangement with Turner, Richardson & Co., Ltd., of Manchester.

Mr. W. H. Buxton was elected president and **Mr. H. Ferry** chairman of the Derby Electrical Society at the annual general meeting held on 16th April.

Sir Herbert G. Williams, M.P., was re-elected president of the Engineer Buyers' and Representatives' Association at the annual meeting held at the Waldorf Hotel, London, on 25th April.

The annual general meeting of the Exeter Electric Club was held on 16th April at the Imperial Hotel, Exeter, when the following officers were elected :—President, **Mr. E. J. Allen;** vice-president, **Mr. G. S. Mogridge;** hon. treasurer, **Mr. J. Rothera;** and hon. secretary, **Mr. W. H. Mortimer.** The immediate past-president is **Mr. L. W. Cornish.** During the meeting a barometer was presented to Mr. Mogridge, the retiring secretary, in appreciation of his services during the past year.

Wing Cdr. R. Stanford-Tuck, D.S.O., D.F.C., has been released by Marconi's Wireless Telegraph Co., Ltd., to join the aircraft division of the English Electric Co., Ltd., parent company of the group of which Marconi's is a member.

Following the retirement of **Mr. A. G. Relf** as a director of the Industrial Electrical Co., Ltd., **Mr. J. R. Radington-Meech,** chairman and managing director of Burdette & Co., Ltd., has been elected to the board.

Mr. Harry Moss, of Bradford, has been elected chairman of the Bradford Group of the Illuminating Engineering Society for the second time.

Mr. G. R. Browne, managing director of M.T.E. Control Gear, Ltd., is sailing to-day (Friday) on the Cunard liner *Britannic* for a six weeks' visit to Canada and the United States.

Mr. **T. Nolan,** A.C.I.S., accountant, Leeds Sub Area, Yorkshire Electricity Board, is to be the next president of the National and Local Government Officers' Association (" Nalgo "). Before nationalization of electricity supply, Mr. Nolan was chief clerk and accountant in the Leeds Corporation Electricity Department.

The North Western Electricity Board announces that it has appointed **Mr. F. Jasper Cole**, M.I.E.E., M.I.Mech.E., at present manager of the No. 7 Sub-Area (centred on Stockport) as manager-designate of the No. 3 Sub-Area (based on Oldham) to succeed **Mr. Edward Binns,** A.M.I.E.E., A.M.I.Mech.E., who retires in November after forty years' service in the electricity supply industry. **Mr. James Mills,** A.M.I.E.E., A.M.I.Mech.E., the Board's purchasing officer, has been appointed manager-designate of No. 7 Sub-Area to succeed Mr. Cole.

Mr. Binns was, before nationalization, chief engineer and manager of the Oldham Electricity Department. He was educated at Elland Grammar School, Halifax Technical College, Manchester College of Technology and Leeds University. After service with the Hull Electricity Department he joined the Oldham undertaking to become, in turn, charge engineer, boiler house superintendent, power station superintendent and joint chief engineer and manager, before being appointed " chief."

Mr. Cole was borough electrical engineer of Blackpool before nationalization. A former student of the Northampton Technical College and Loughborough College, he had held the appointments of borough electrical engineer at West Bromwich, chief electrical engineer and manager, Shipley U.D.C., and deputy borough electrical engineer and manager, Darwen, before taking up his Blackpool appointment in 1945. While at West Bromwich he was a member of the Board of the West Midlands J.E.A. For a year following nationalization he was executive officer at Blackpool on behalf of the B.E.A. He was technical engineer in the Board's No. 5 Sub-Area when he was appointed to his present post in 1951.

Mr. Mills, who was borough electrical engineer and manager at Bury, Lancs, for two years before nationalization, was educated at Stand Grammar School, Whitefield, Lancs, and the Manchester College of Technology. He served with the Lancashire Electric Power Co. and the Bradford Electricity Department before becoming power station superintendent at St. Helens in 1943. He was successively technical assistant and then deputy to the St. Helens borough electrical engineer and manager before becoming manager at Bury.

Mr. W. Dudley Morgan has been appointed district manager, South West England, for W. T. Glover & Co., Ltd., at their Bristol office. He was previously branch manager of the Hotpoint Electric Appliance Co., Ltd., having opened the Bristol branch for that company in 1933. Mr. Morgan was educated at the University and Technical College at Cardiff and obtained the joint diploma in engineering of the two colleges. He joined the General Electric Co., Ltd., and was later with Standard Telephones & Cables, Ltd.

Mr. W. D. Morgan

Mr. R. D. Hamer, vice-president and director of Aluminium Laboratories, Ltd., has been elected president of the Aluminium Development Association. The new vice-president is **Mr. H. G. Herrington** and Mr. G. W. Lacey has been re-elected chairman of the Executive Committee.

The Council of the **South Wales Institute of Engineers** is sponsoring an engineers' Coronation dinner and dance, to be held in the Assembly Rooms, City Hall, Cardiff, on 12th June, in collaboration with the local sections of kindred societies. Tickets (£2 5s double, and £1 5s single, for the dinner and dance, and £1 1s double and 12s 6d single, dance only) can be obtained from Mr. E. S. Douthwaite, secretary of the Institute, Park Place, Cardiff.

The London Sapper Reunion organized by the London Group of the **Royal Engineers' Association** is taking place on 16th May (6.30—11 p.m.) at the Duke of York's H.Q., Chelsea, S.W.3. Admission will be by ticket only and tickets are obtainable from Mr. J. S. Pearson, Room 31, Horse Guards, London, S.W.1, at 3s each.

Mr. F. J. Cole

Mr. E. Binns

Mr. J. Mills

Mr. H. Boyd Brown, B.Sc.(Eng.), A.M.I.E.E., assistant to the chairman of Associated Electrical Industries, Ltd., has been appointed managing director of the First Electric Corporation of South Africa as from 1st May. Mr. Brown is a South African. He joined Metropolitan-Vickers as a college

Mr. H. Boyd Brown

Mr. W. A. Ankerson

apprentice in 1931 and remained with the company until 1949. During this period he served the M-V Export Company in South Africa, Holland and England, and, among other appointments, was in charge of the development section of the Motor Engineering Department, and sales manager of the Motor Department before joining A.E.I.

Mr. W. A. Ankerson, B.Sc.(Eng.), A.M.I.E.E., succeeds Mr. H. Boyd Brown as assistant to the chairman of Associated Electrical Industries, Ltd. Mr. Ankerson obtained his degree at London University and joined Metropolitan-Vickers as a college apprentice in 1932. In 1936 he transferred to the Metropolitan-Vickers Electrical Export Co., Shanghai office, as a sales engineer and in 1938 was appointed manager of that office. In 1942 he was seconded to the Australian General Electric, Pty., as chief industrial motor designer. He rejoined the M-V Export Co. in 1946 and resumed his original post in China. On returning to England in 1949 he was appointed manager of the Dominions Division of the M-V Export Co.

The jubilee dinner of the **Electrical Engineering Department, H.M. Dockyard, Portsmouth,** was held at the Clarence Pavilion, Southsea, on 24th April. It marked the celebration of the fiftieth anniversary of the first appointment of electrical engineering officers in Admiralty service. The toast of the Department was proposed by the Admiral Superintendent, H.M. Dockyard, Portsmouth, Rear Admiral A. G. V. Hubback, C.B.E., and responses were made by the present manager of the Department, Mr. E. F. Kill, M.I.E.E., and the Assistant Director of Dockyards, Admiralty, Mr. A. H. Parker, M.I.E.E. Guests, who included Commander (L.) J. C. Turnbull, A.I.Mar.E., M.I.E.E., R.N., chairman of the Southern Centre, I.E.E., and Mr. R. H. Coates, B.Sc., A.M.I.C.E., A.M.I.E.E., M.I.E.E., divisional controller, British Electricity Authority (Southern Division), Departmental Heads of Portsmouth Dockyard and Captain (L.) K. H. T. Peard, C.B.E., A.D.C., A.M.I.E.E., R.N., Commanding Officer of the Naval Electrical School, H.M.S. *Collingwood*, were welcomed by Mr. E. R. Evans, B.Sc., A.M.I.E.E., deputy manager of the Department. The dinner was followed by dancing.

OBITUARY

Mr. Percy William Laverick, A.M.I.E.E., chairman and managing director of Line Equipment, Ltd., died at his home in Westminster, on 28th April, at the age of sixty-one. Mr. Laverick was for many years associated with Electric Control (later Allen West, Ltd.), and was a founder director of Switchgear & Equipment, Ltd., Banbury. In 1946 he founded Line Equipment, Ltd. Mr. Laverick served in the Royal Horse Artillery during the 1914-18 war, and was awarded the Military Cross.

The late Mr. P. W. Laverick

Mr. Simon Orde, Engineering Information Department manager of the B.B.C., died on 23rd April at the age of fifty-nine.

Mr. A. L. Lunn.—The death occurred at Belmont, Surrey, on Saturday last of Mr. Alfred Lawrence Lunn, M.I.Mech.E., M.I.E.E., formerly electrical engineer (generation) with London Transport. Mr. Lunn, who was sixty-nine, began his career in the Manchester Corporation Electricity Department in 1906 and, apart from a five-year period at Sunderland, remained in Manchester until 1930 when he was deputy chief engineer. In that year he left to join the London Electric Railway as deputy electrical engineer and in 1933 he was appointed to a similar position with the London Passenger Transport Board. A year later he became electrical engineer (Underground section), London Transport, and from 1937 to 1948 (when he retired) he was electrical engineer (generation).

The late Mr. A. L. Lunn

Mr. Lunn was a member of the I.E.

Council for eight years and he was a past chairman and local hon. secretary of the North Western Centre. He was president of the Electrical Power Engineers' Association during the first two years of that organization's existence.

WILLS

Col. J. S. A. Walker, J.P., T.D., M.I.C.E., M.I.M.E., a director of Walker Bros. (Wigan), Ltd., and part-time member of the North Western Electricity Board, who died on 17th October last, left £25,595 gross (£25,111 net).

Mr. V. Walker, M.I.E.E., who was with the North Western Division of the B.E.A. and who died on 8th January last, left £2,148 gross (£2,108 net).

Mr. G. Gibson, C.H., LL.D., formerly chairman of the North Western Electricity Board, who died on 4th February last, left £3,070 gross (£2,898 net).

Mr. F. C. Faulkner, a director of Electrical Services, Faulkner, Ltd., Tunbridge Wells, who died on 9th March last, intestate, left £2,799 gross (£2,634 net).

Mr. H. C. S. Runnals, former manager of the Swansea branch of the General Electric Co., Ltd., who died on 14th February last, left £3,402 gross (£3,308 net).

Gas Turbines

TWO papers on an experimental single-stage air-cooled gas turbine were presented at a general meeting of the Institution of Mechanical Engineers on 1st May. The first, by Messrs. J. Reeman and R. W. A. Buswell (General Electric Co., Ltd.), dealt with design of the turbine and manufacture of internally cooled nozzles and blades. Present maximum temperatures of 1,250 deg F for long-life duties and 1,500 deg F for short-term operation were fixed, the authors stated, by the strength of the heat-resisting materials employed. Failing availability of new materials, cooling would become necessary to secure increased efficiency through raising maximum operating temperature by 500 deg F, without a corresponding increase in metal temperatures of the stressed parts.

The primary object of the design was to obtain satisfactory air cooling of blades operating at 2,192 deg F with numerous small cooling passages and a suitable combustion chamber. The pressed powder technique used to introduce the small passages in heat-resisting material from which blades could be machined was also described.

In the second paper, Mr. D. G. Ainley (National Gas Turbine Establishment) showed that when cooling air equivalent to 2 per cent by weight of the total gas flow through the turbine was fed to the rotor blades, the gas temperature could be 486 deg F above that allowable for uncooled blades.

Development and Prospects

In an address to the Society of Engineers on 4th May, Mr. W. E. P. Johnson (managing director, Power Jets (Research & Development), Ltd.) discussed "Gas Turbines in Retrospect and Prospect" from the propounding by Stolz in 1872 of the concept of an axial compressor directly driven by an axial turbine. He said that practical developments were held up by metallurgical and aerodynamic shortcomings, including compressor efficiencies.

The lecturer then traced progress made in the 1920's, Whittle's approach to the subject from 1936 and the most recent position. His view was that industrial engineering could learn much from aero-engineers and vice versa and he disagreed with the common assumption that a life of 100,000 hours for industrial plants was necessary on economic grounds.

In conclusion Mr. Johnson set out the possible fields for gas turbines, more (he said) as a declaration of faith than as a factual statement, but seemingly practicable as being implicit in, or in line with, current technical tendencies.

Snowy Mountains Tenders

AUSTRALIA is to call immediately for tenders from overseas contractors for part of the work on the second stage of the Snowy Mountains hydro-electric project. Senator Spooner, Minister for National Development, in making the announcement, said that during the next five years the Government planned to spend £A46·5 million (£37·2 million sterling) on the project and a total of more than £A58·5 million (£46·8 million sterling) by 1961. The present call for tenders related to work on the Abaminaby dam lying between the hills in the shadow of Mount Kosciusko. Separate tenders would be asked for covering a 14-mile tunnel with ancillary works; a 1½-mile pressure tunnel and surge shaft for Tumut Pond dam; and an underground power station, pressure shafts and tail race tunnel. The contracts would be let on firm prices quoted by tenderers with provision for variations in wage rates and costs of materials.

Industry and the House

Control of Atomic Power

By A. M. F. PALMER, A.M.I.E.E., M.P.

THE Prime Minister last week made the somewhat unexpected announcement that the Government had decided to transfer responsibility for the control of atomic energy from the Ministry of Supply to a non-departmental organization. Many will remember that the Act of 1946 at present vests in the Minister of Supply power to " produce, use and dispose " of everything connected—past, present and future—with atomic energy.

Sir Winston Churchill—his new style comes strange to the pen—explained that while the Government had made up its mind on the need for a change in the system of control, his own views and those of his colleagues were still undecided on how this could be best brought about. Therefore it was proposed to set up a committee consisting of Lord Waverley, Sir Wallace Akers and Sir John Woods to " work out the most suitable form for the new organization."

Lord Waverley, who is appointed chairman, was once well known as Sir John Anderson. He is a great favourite, of course, of the present and of past administrations for this kind of duty. Sir Wallace Akers is a director of Imperial Chemical Industries and Sir John Woods a director of the English Electric Company; before his retirement in 1951 Sir John was permanent secretary to the Board of Trade.

Opposition Criticism

The Opposition, with Mr. Attlee, Mr. Strauss and Mr. Morrison well to the front, did not conceal their dislike of the manner and method of the Prime Minister's announcement. They thought that the Government was much in danger of putting the cart before the horse—if one may be permitted such an old-fashioned illustration in so up-to-date a context. As Mr. Morrison observed tartly: " The Government have appointed a committee to find out why the Government are right." Mr. Attlee saw an *eminence grise*, Lord Cherwell, behind the change, although Mr. Strauss asked for a White Paper to be published. To add parliamentary flavour to the occasion Opposition back benchers pretended to see something especially significant in the absence of Mr. Sandys, the Minister of Supply, from Sir Winston's side during these questions. He had gone on a protest strike, somebody genially suggested. But the Prime Minister did not shift his ground a single fraction. " In principle," he repeated, the proposal was " right " and would be " of real advantage to the country."

Industrial Output

When on Wednesday the House of Lords discussed economic policy the Commons plunged into a debate on production opened by Mr. Cledwyn Hughes using the private member's privilege of bringing in motions on the House's going into Committee of Supply. He said that in 1952 for the first time since the war British industrial production had fallen by nearly three per cent. The Government boasted that it had restored confidence in sterling, but it had given no real practical hope for the future.

In answer to this Mr. Shepherd, a Conservative back bencher, made the unusual reply that in present circumstances a certain gross reduction in production was all to the good. The country, he thought, was better off for what had happened. Industries now had a breathing space that would allow concentration on quality.

For the Liberals Mr. Holt stated that the general direction of the Government's economic policy was approved by them. " Tighter money " had brought a " sense of reality " to industry.

In a not over-controversial speech from the Opposition front bench Mr. Robens, a former Minister of Labour, warned the House that the nation was now entering on

the greatest competitive struggle for markets it had ever known. Following this up, Mr. Watkinson, the present Parliamentary Secretary to the Ministry, said that the problem facing everybody was how best to get the facts and the truth down to workshop floor level.

Mr. Hughes' motion, which had noted with "deep concern" the fall in industrial output and blamed the Government for not taking "effective remedial measures," was lost by 263 votes to 242.

Bidding has been officially re-opened in Seattle for the electrical equipment for the Chief Joseph dam contract. This announcement follows close on the further questioning by Members in the Commons on the treatment by the American authorities of the English Electric offer. Although in the nature of things the questioning came from the Labour side of the House, it can be said that privately Conservative Members are just as concerned about the way things have gone to date. The whole incident has undoubtedly given a serious set-back to previously developing confidence in the possibility of trade superseding aid in Anglo-American affairs.

PARLIAMENTARY NEWS

By Our Special Reporter

IN the House of Commons last week Mr. Palmer asked the Minister of Fuel and Power if he would take steps to ensure that, in carrying out the recommendations of the Ridley Report on National Fuel Policy, the principle of free consumer choice was maintained between gas, electricity and solid fuel for domestic use.

Mr. Geoffrey Lloyd replied in the affirmative.

Mr. Nabarro asked whether the Ridley Report, while supporting competition between these industries, had not pointed out that such competition would only be possible where prices were properly related to costs, and what was being done in that connection, particularly with regard to the electricity supply industry.

Mr. Lloyd said that the importance of those points was recognized and he was in touch with the electricity supply industry on them.

Welsh Electricity Board?

Mr. Gower asked the Minister of Fuel and Power if he would take steps to ensure that a separate Electricity Board was set up for Wales and Monmouthshire in place of the existing two Boards which now served the area.

Mr. Geoffrey Lloyd said that as at present advised he was not contemplating changes in the existing organization.

American Hydro-electric Project

Mr. Palmer asked the President of the Board of Trade if, in view of the need for dollars, he would make a further statement on the rejection by the United States authorities of the tender by the English Electric Co. for generators and transformers at the Chief Joseph hydro-electric scheme, Washington, in spite of this tender being $932,000 below the nearest United States price quoted.

Mr. Mackeson said that the United States Secretary of the Army had stated that it had now been decided to call for new bids on this contract. This decision was also referred to by President Eisenhower at a recent Press conference. He gathered from these statements that the American authorities felt that they could not assess the comparative quality of the British and the American plant. He could only say that in his view every effort should be made in such a case to obtain the necessary information for this purpose from the firms concerned rather than to invite fresh bids and thus, in effect, give another chance to the firms whose prices were too high.

Mr. Palmer: Has it been made plain to the American authorities that not only is this business bad in relation to this contract but is bound to have a most discouraging effect generally on British manufacturers anxious to compete in American markets in the spirit of trade not aid?

Mr. Mackeson: The decision has now been taken by the U.S. Administration and we must await developments. I should be sorry to say anything which would exacerbate the matter.

Mr. Gaitskell asked if any assurance had been sought that if the English Electric Co. won the next contract there would be no interference from the United States Government.

Mr. Mackeson replied that no assurance had been sought.

Mr. Palmer gave notice that he would raise the matter on the adjournment as soon as possible.

Scottish Farm Supplies

Mr. Patrick Maitland asked the Secretary of State for Scotland what percentage of farms

had now been connected with mains electricity in the Clyde, Glasgow, Dumfries and Galloway, Ayrshire, and Lanarkshire Sub-Areas of South-West Scotland.

Mr. Stuart said that the figures asked for were 83, 100, 62, 62 and 73 respectively.

B.B.C. Reception

Replying to Sir Harold Roper, the Assistant Postmaster General (Mr. Gammans) said he was aware that in some parts of the country the reception of B.B.C. sound programmes was poor, and both the B.B.C. and the Government would keep this fact well in mind in their plans for future development in sound and television. The only satisfactory solution to the problem was v.h.f. transmission, but the rate of progress which could be made with it and other developments must be determined by the amount of capital investment which would be justified in the light of our general economic position.

Atomic Power Station

The Minister of Supply (Mr. Sandys) told Mr. Frank Anderson that it had been decided to build an experimental atomic power station on the Calder Hall site alongside the Ministry of Supply Atomic Energy Establishment at Windscale, Sellafield. Work on the preparation of the site would start in a few days' time.

Atomic Power Committee

Replying to Mr. George Strauss, Sir Winston Churchill, the Prime Minister, said that considerable strides had been made in the development of methods for using atomic energy for industrial purposes. In order to secure the most rapid and economical development in the field of atomic energy, both military and industrial, the Government had set up a Committee, consisting of Lord Waverley (chairman), Sir Wallace Akers and Sir John Woods, "to devise a plan for transferring responsibility for atomic energy from the Ministry of Supply to a non-departmental organization and to work out the most suitable form for the new organization, due regard being paid to any constitutional and financial implications."

Private Trading in Copper

Sir Arthur Salter, Minister of Materials, stated on Monday last that, after reviewing the situation in all its aspects, the Government had decided that private trading in copper should be restored at the earliest practicable date. The necessary notice was being given to the Commonwealth producers and from 5th August the private import and sale of copper would be permitted and the Copper Distribution Orders would be revoked. The London Metal Exchange would re-open for dealings in copper on the same day. An Order was being made, with effect from 5th May, authorizing private contracts for the delivery of metal after the end of public trading.

Australian Electrical Trade

THE latest quarterly summary of statistics of Australian trade, covering the September quarter, testifies to the effect on electrical imports of the enforced restrictions. Their total value during the period under review was only £A4,669,000 against £A7,197,000 in the September quarter of 1951. Only the transformer and rectifier group showed an increase, as will be seen from the accompanying table.

Class of Goods	Sept. quarter 1951 £A 000	Sept. quarter 1952 £A 000
Batteries and accumulators	166	134
Cable and wire, covered	710	648
Communication equipment, including radio	1,436	510
Dynamo-electric machines	1,641	1,261
Heating and cooking appliances	386	82
Lamps, filament	261	34
Protective equipment	184	64
Regulating, starting and controlling apparatus	1,080	746
Sparking plugs	149	57
Transformers and rectifiers	657	695
Other electrical machinery and appliances	527	438

During the same period Australian exports of dynamo-electric machinery and electrical appliances and equipment totalled £A494,000 in value compared with £A500,000 during the corresponding period of 1951. The total included batteries and accumulators £A86,000 (£A125,000) and communication equipment £A195,000 (£A137,000).

I.E.E. Annual Report

THE annual report of the Council of the Institution of Electrical Engineers for the session 1952–53 and the accounts for the year ended 31st December, 1952, are to be presented at the annual general meeting on Thursday, 14th May, 1953. Copies of both the annual report and the accounts can now be obtained by members of the Institution on application to the Secretary at Savoy Place, Victoria Embankment, London, W.C.2.

Machen Scheme Rejected

IT is reported that the Minister of Fuel and Power has withheld consent to the proposal of the British Electricity Authority to construct a power station at Lower Machen in Monmouthshire. The scheme was the subject of a public inquiry recently (*Electrical Review*, 13th March, page 593) when the objectors included the Monmouthshire County Council, Magor and St. Mellons R.D.C., Machen U.D.C., the National Farmers' Union and the Council for the Preservation of Rural Wales.

British Industries Fair

Impressions of This Year's Exhibition

IT is always difficult to assess the value to electrical exhibitors of participation in the British Industries Fair. Business, particularly in the heavier products, rarely follows immediately (results may accrue years afterwards) and it is extremely difficult to obtain sound evidence of the effects. Experience this year follows much the same pattern as in the past and most exhibitors declare themselves satisfied with their achievements. This applies especially to the manufacturers of domestic appliances who are in a position to get somewhat quicker results than those in other branches of the industry.

In general, however, the number of potential customers visiting the stands seems to be rather lower than in recent years. Nevertheless genuine interest does appear to have been aroused in any new developments that have taken place during the past year.

Some manufacturers wonder whether the Fair would not be the better for being held every other year, but this move appears to be an unlikely eventuality, at any rate in the immediate future. In any case the period of next year's Fair has already been fixed, 3rd to 14th May. There is, of course, the perennial question of whether electrical manufacturers should hold an exhibition of their own. Certainly there appears little indication of any reversal of the tendency for the Electrical Section at Castle Bromwich to become rather more engineering than electrical and for the domestic electrical appliance manufacturers to find other methods of bringing their products to the notice of potential buyers.

However that may be, to the casual observer the interest in the 400 electrical or allied stands appears to be as strong as ever. During his visit to Castle Bromwich on Thursday last week the Duke of Edinburgh spent much of his time looking at electrical apparatus and many of the 62 stands which he called at (his planned tour provided for only 30 calls) were in the Electrical Section.

"Electrical Day"

Many prominent representatives of the electrical industry were present at Castle Bromwich on the occasion of the official "Electrical Day" last Tuesday. They were welcomed at lunch by Mr. J. E. Bellis, chairman of the Building and Sites Committee of the Fair.

Mr. C. H. Torrance, Deputy High Commissioner for South Africa, said that his visit to the Fair had made him realize its importance as the shop window of British industry. South Africa had for a long time been largely dependent on British

The Duke of Edinburgh inspects a model of a 275 kV transformer and tap changer at the Metropolitan-Vickers stand. Left to right: The Lord Mayor of Birmingham (Ald. W. T. Bowen), the Duke, Mr. A. Coates, general sales manager and director, M.V., and Mr. A. B. Waring, president of the Birmingham Chamber of Commerce

manufacturers for electrical equipment. The English Electric Co., Ltd., had orders in hand worth nearly £2,000,000 for electric locomotives and contracts had also been placed for several millions of pounds worth of telephone equipment as well as for large quantities of electricity supply plant. The war had given South Africa a fillip in the industrial world, but it had a long way to go before it reached the real zenith to be seen at the B.I.F.

The industrial development of South Africa must, however, go hand in hand with agricultural development. In a young country it was necessary to see that it did not over-industrialize in any commodity. British manufacturers had played a part in helping to develop South African industry but South Africa was still dependent on this country for its major capital goods. Recently there had been a great improvement in the delivery of such equipment and he hoped that, with better supplies of raw materials, it would be possible to maintain and improve these deliveries.

Mr. D. D. Walker, chairman of the British Electrical and Allied Manufacturers' Association, said that the electrical industry had very wide responsibilities. One of its primary jobs was to produce tools for the improvement and quickening of production, and it also had to produce the electricity required to operate them. The electricity supply industry was restricted only by the amount of capital available. Last year it installed 1,500 MW of generating plant and there was no reason why it should not increase that figure if allowed to.

As well as supplying home demands the industry had done a remarkable job in the export field. Last year it was the second largest exporting industry, supplying equipment to the value of £218 million in direct exports alone.

One of the necessities of a healthy export business was a prosperous home market. The industry was grateful to the Chancellor of the Exchequer for the reductions in purchase tax, but it would like him to eliminate the differential as compared with other appliances and give the public the opportunity to exercise freedom of choice.

Lundberg Switch Test

AT the recent Electrical Engineers' Exhibition the Simplex Electric Co., Ltd., had on its stand one of the new Lundberg "Miniac" switches being continuously operated on full load. Visitors were invited to estimate the number of operations the switch would make before breaking down. The end came at the 490,823rd operation and Mr. C. Pickard, assistant commercial engineer, Tunbridge Wells District, South Eastern Electricity Board, who had put in an estimate of 437,000 operations, was presented with a "Creda EV.13" cooker for getting nearest to the actual figure. Messrs. J. V. Foster, J. H. Zieger, K. R. Argyle, J. Wheeler and R. M. Long, the next nearest, were given "Halo" irons.

Mr. E. G. Plucknett, joint general manager and director of the Simplex Electric Co., made the presentations and emphasized the fact that the tested switch was one chosen at random from the production line.

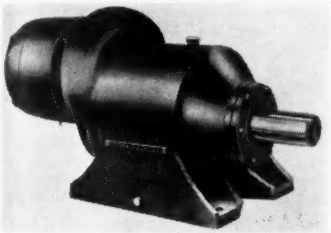
At the presentation ceremony: Messrs. J. D. Johnson (commercial manager, Simplex Electric Co.), C. Pickard, the winner, and E. G. Plucknett

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

Geared Motor and Speed Reducer

THE type E.S.R.15 geared motor and speed reducer made by ELECTROPOWER GEARS, LTD., Kingsbury Works, Kingsbury Road, N.W.9, is designed for duties where extremely low speeds are required with high output torques. The maximum ratio in a single box



Electropower E.S.R.15 geared motor and speed reducer

is 8,225 : 1, but a combined integral unit can be offered for ratios up to 2,500,000 : 1. The maximum output speed offered is 26 r.p.m. with an input of 12 h.p. at 1,425 r.p.m. These units can be mounted in any position and any make or type of motor can be fitted. Furthermore, the units can be offered as integral speed reducers for direct belt or chain drive, alternatively incorporating an electric motor drive.

Moulded Rubber Accessories

"Duraplug" three-pin 5 A connecting sockets and three-pin 5 A weatherproof cable couplers are now being made in moulded rubber by W. W. HAFFENDEN, LTD., Richborough Rubber Works, Sandwich, Kent. The connecting socket (price 5s 9d) will fit any standard three-pin plug. The cable entry is in line with the cable entry of the plug so there is no risk of fracture when in use by any pull exerted. A 15 A connecting socket will shortly be available. The weatherproof cable coupler (price 13s 9d complete, or plug 6s 6d, and socket 7s 3d) is fitted with a tapered cable entry, which can be trimmed to fit all thicknesses of cable. The coupler has been tested by immersion in water for a period of twenty-four hours and no penetration has taken place; the parting pull is in excess of 25 lb.

"Duraplug" three-pin 5 A connecting socket and weatherproof cable coupler and (right) "Abcon" conduit coupler

Non-Inflammable Transformers

The installation of oil filled h.v. transformers in public buildings and office blocks has in the past been subject to restrictions, tending to preclude their general use except in basements. ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI, 56, Victoria Street, London, S.W.1, have developed dry type air cooled transformers using Class "B" insulation comprising inorganic materials of non-inflammable character which are proof against fire risk and explosion.

The range from 50 to 5,000 kVA has been designed for primary voltages from 3 kV to 11 kV and any secondary low voltage. The size and weight of the units have been greatly reduced by using crystal orientated magnetic core plates of "Hypersil" low loss steel. An improved method of distribution of power reduces to the minimum the size and extent of the l.v. network. It is now possible to take the h.v. cables directly to the centre of the load by installing the transformers inside buildings, avoiding the use of outdoor substations or kiosks.

Conduit Coupler

"Abcon" conduit couplings are made by ABBOFLEX, LTD., Perry Road, Teddington, Middlesex, to fit most sizes of conduit. Essentially these couplers are for joining rigid to flexible conduit and an advantage is that no threading of the rigid conduit is required. They can also

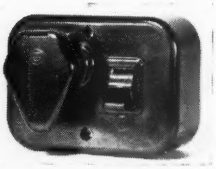
be used to couple rigid to rigid conduit. When both locknuts are firmly in position the conduit is gripped tightly, giving good earth bonding.

New Range of Batteries

The latest range of " Exide " heavy duty and standard batteries to be introduced by CHLORIDE BATTERIES, LTD., Clifton Junction, near Manchester, has been produced for tractors, special vehicles or powered contracting and industrial plant of all types. Apart from being less bulky and up to 20 per cent lighter than other heavy duty batteries of comparable capacity, the makers claim superior starting performance for the new range.

Switch Socket and Plug

A three-pin 5 A shuttered switch socket and plug are now being made in accordance with B.S. 546 by GEORGE BECKER, LTD., Ampere



Becker three-pin 5 A shuttered switch socket and plug

Works, Northend Road, Wembley Park, Middlesex. They are robustly constructed of moulded anti-tracking material and are designed for easy wiring. The switch socket is suitable for use in a.c. or d.c. circuits.

Installation Accessories

Among a number of new wiring accessories introduced by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, is the S2290 e.s. backplate lampholder which is being supplied as part of the equipment for the new Toronto Subway and has been approved by the Canadian Standards Association. It is generally similar to the S1190 lampholder, but has been modified to suit lamps having American e.s. caps. A thickened porcelain is used to increase the depth of well and the ferrule fixing plate is marked with the rating (660 W, 230 V) and is finished in a distinguishing colour. The price is 48s 4d a dozen. A similar lampholder, fitted with a short-circuiting device for series burning lamps, is priced at 53s a dozen.

A new 10 A flat two-pin socket-outlet (S2691) fitted with a fixing strap to suit American pattern boxes was produced originally to meet orders from the British West Indies. It is also suitable for use in New Zealand; it costs 65s 4d a dozen. The plug for use with it is catalogued S692.

To meet the demand for a 15 A ceiling switch, designed primarily for the control of heating apparatus in bathrooms, a new " Mutac " switch is being manufactured. It is known as the S3645 and operates on the same principle as the tumbler type " Mutac " silent a.c. switches, interrupting a.c. by slow separation of silver contacts. It is obtainable in brown and in cream at 64s 8d a dozen.

A new 2⅝in diameter 2 A three-pin brown Bakelite flange socket-outlet (S2940/801) with fixing holes at 2in centres to suit B.S. 31 boxes, is supplied complete with plug at 75s 4d a dozen. A similar socket rated at 5 A can be supplied with a flat top plug (S2970/891A) at 89s 8d a dozen, or a finger shield plug (S2970/2884) at 87s a dozen.

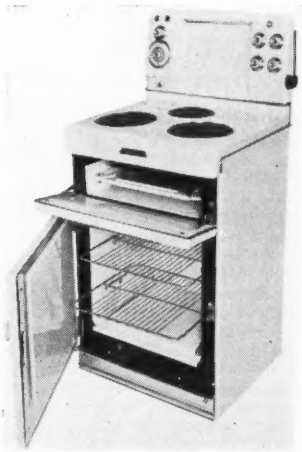
Frying Pan

The " Universal " electric frying pan now available from S. I. ENGEL, 23–25, Kensington Park Road, London, W.11, has been designed for the convenience of flat or hotel dwellers or for normal home use. It consists of a 7in tinned steel pan on the underside of which is welded a threaded bolt. To this is fitted, by means of a wing nut, a circular metal tripod measuring 5in in diameter which houses a 450 W heating element. The pan is thus easily detachable for cleaning purposes.

The appliance is provided with 6ft of 3-core flex and is suitable for use on 200/250 V mains. The retail price is 25s.

De-luxe Cooker

In last week's issue details were given of the " Falco Royal " de-luxe cooker introduced by FALCO ELECTRICAL APPLIANCES, LTD., Corporation Road, Audenshaw, Manchester. The new model is illustrated below.



" Falco Royal " cooker

Impregnated Pressure Cables

Some Operating Experiences

A PAPER presented before the Supply Section of the Institution of Electrical Engineers on 29th April by Dr. L. G. Brazier, Mr. D. T. Hollingsworth and Dr. A. L. Williams (British Insulated Callender's Cables, Ltd.) made an assessment of the impregnated pressure cable. The authors defined this type of cable (an entirely British development) as one having a mass-impregnated dielectric maintained under a nitrogen pressure of 200 lb/sq in without an intervening membrane. From 1940 onwards 150 miles had been laid in this country at 33, 66 and 132 kV and installations abroad were in progress. The first 132 kV three-core cable was laid in 1944 (Burford, Oxon).

Preliminary tests on a single cable, carried out at the K.E.M.A. establishment, Holland, in 1937–38, proved fitness for service at 260 kV. Another test, still in progress, was on a 220 kV cable at Fontenay, Paris. About twelve miles of 33 kV three-core cable with seamless aluminium sheathing was now in service. Round stranded conductors had always been used. Dielectric design was based upon maximum electric stresses in kV/cm at the conductor of 85 for 33 kV, 93·5 for 66 kV, 100 for 132 kV and 110 for 275 kV.

After discussing other features of design of the cable itself, the authors dealt with the main features of the accessories and of the pneumatic system with a reference to possible improvements in the latter and other future developments generally. A section of the paper was allocated to an explanation of all the reported faults on the cables, joints and sealing ends, gas leakages and their location and compound movement. Only one failure of the cable itself has been experienced; this was attributable to abnormal ground subsidence.

DISCUSSION

Opening the discussion, Mr. D. B. Irving (London Electricity Board) said that the impregnated pressure cable with its accessories was at a stage of development at which the user could have complete assurance of its reliability in service. There was room, however, for improvement in pneumatic performance, with a reduction in the time taken in the gassing and de-gassing processes. Aluminium as a sheathing material was advantageous because it required no reinforcement to withstand internal gas pressure, but really adequate anti-corrosion protection on the cable was essential.

Mr. S. E. Goodall (W. T. Henley's Telegraph Works Co., Ltd.) regarded the development of cables of that type as a notable British achievement. Although there were certain obvious merits in the design of the mechanical joint it possessed the inherent disadvantage in that a good deal of precise work was needed before the joint was assembled.

Mr. C. H. Jolin (Merz & McLellan) asked for assurance that no distortion of the joints would occur in the event of uncontrolled release of the gas, and also that blockage of the gas channels did not in fact occur. He had done a type-test on some 66 kV cable of this class; the three-core cable passed easily but the single-core failed, and he had been unable to explain why the latter should have a lower factor of safety than the other. One feature which should be pursued energetically was the provision of waterproof coverings which did not change so much with age.

Mr. D. P. Sayers (B.E.A.) suggested that a more correct title would be "An Outline Record of Operating Experience," because an assessment should also deal with the economic aspects. A critical comparison of the cost of this and other types of cable available for similar service would have been of value. There were also no references to ratings or temperature rises, and no comparison between the B.E.A. impulse requirements and those of the French authorities at Fontenay, all of which would have been very helpful.

Professor M. G. Say (Heriot-Watt College) referred to graded paper dielectrics which had been proposed by the Swiss twenty-five years previously, but of which

nothing more apparently had been heard. He looked forward to the time when there would be improved stress control, forced cooling, and possibly an entirely revolutionary class of dielectric.

Mr. G. F. Peirson (Midlands Electricity Board) expressed the opinion that the rucking of the longitudinal reinforcing tapes must have occurred during manufacture and not during the installation of the cable. The method of laying was of paramount importance in ensuring that the external serving and the thin-wall dielectric were undamaged. A very desirable reduction in cost would result if longer tube lengths in aluminium could be obtained; this would reduce the number of joints required.

Dr. A. N. Arman (Pirelli-General Cable Works, Ltd.) stated that rucking of the longitudinal tapes could, and did, occur after manufacture. Had the authors any definite test information to show that any adverse effects followed the application of longitudinal stresses of the order of 1·5 kV/cm or 2 kV/cm? His own view was that radial stresses were always the determining factor.

Mr. C. C. Barnes (B.E.A.) mentioned trouble experienced in service with poorly applied metallized paper conductor screening. He asked how the fatigue resistance and extensibility characteristics of the lead alloy suggested by the authors compared with those normally offered by cable makers for conditions where severe vibration existed. The observation that leaks below one litre per minute had no significance was rather sweeping, since such a leak represented a cylinder life of only two days.

Mr. E. L. Davey (W. T. Glover & Co., Ltd.) suggested that Table 1 would be improved by the inclusion of such things as maximum conductor pressure, maximum electrical stress and gas pressure values. In seventeen years' experience he had never met any trouble associated with metallized screening tapes.

Mr. G. S. Buckingham (Midlands Electricity Board) suggested that rubber was not the best material to use for the protective serving of reinforcement tapes, bearing in mind the possible life of the cable in the ground. He considered also that the solution to the frothing problem was the use of pre-impregnated paper.

Mr. C. T. W. Sutton (Enfield Cables, Ltd.) suggested the use of carbon paper screening.

Mr. J. V. W. Richards (Johnson & Phillips, Ltd.) outlined a method of increasing the interval between barrier positions without sacrificing pneumatic efficiency, by reducing the pneumatic resistance by the use of three pipes.

Mr. A. M. Morgan (Enfield Cables, Ltd.) said that the specification of the size of leaks in terms of the volume of gas lost in unit time was insufficient in most cases. While the halogen leak detector was efficient it had limitations imposed by the temperature-sensitive element, which necessitated the maintenance of constant temperature on the detector head. With regard to radioactive isotopes, his firm had found methyl bromide the most successful, having a much greater gamma ray radiation and a shorter half-life.

Mr. C. H. Gosling emphasized the need for dielectric resistance tests after installation, in order that any damage to the anti-corrosion protection could be rectified immediately.

Dr. A. L. Williams, in a brief reply, said they had a very large programme of corrosion testing in hand, under actual site conditions, with a view to improving the method of corrosion protection. For leak location their preference was for the oxygen column method which, although slow, was infallible.

Mersey Railway Jubilee

ON 3rd May the Mersey Railway, the first English steam railway to be electrified, celebrated the completion of fifty years of electrical operation. Construction of the railway was started in 1880; the work included a tunnel under the Mersey from Birkenhead to Liverpool. The line was officially opened by the Prince and Princess of Wales (later King Edward VII and Queen Alexandra) early in 1886 and went into service on 1st February that year. The system incurred heavy losses and it was considered that the situation could only be saved by electrification. The conversion was completed without interfering with the normal service and the electric trains commenced running on 3rd May, 1903. From that day onward traffic began to pick up and the line has never looked back.

In addition to being the first steam line to be electrified the Mersey Railway was among the pioneers in this country of colour light signalling working in conjunction with automatic train stops. The system is now a part of the London Midland Region of British Railways.

Engineering in Europe

Survey of Current Literature

THE difficulty and dangers encountered in breaking small currents which occur in the cutting-out of idling transformers or lines are due to the fact that the system as a whole, and also its parts after their severance, represent oscillating systems with negligible damping. On the other hand, the opening arc, being a gas discharge, follows laws of its own, particularly since not only one but several arcs may occur. The interaction of the oscillating systems, with possible shifts of the neutral points against earth, and the opening arcs may result in considerable, and uncontrollable, voltage surges. Also, the de-ionization of the break on the rupturing of inductive circuits is so rapid that the current gradient is from two to three orders of magnitude higher than at 50 c/s. The voltage surge is correspondingly steep.

All this justifies the provision of special devices on power circuit breakers for dealing with small breaking currents. These auxiliary devices mostly use liquid pressure and flow for arc-quenching and are essentially of the oil-pump type, to compensate for the insufficient pressure effects produced in the oil by small currents. These devices are described and shown in schematic representations in the article which also reproduces some oscillograms of the breaking of small currents with and without pressure-compensating installations. Though promising, these devices have yet to prove their full reliability in actual service conditions.—" Breaking of Small Inductive and Capacitive Currents by Pressure-Compensating Circuit Breakers," K. Autenrieth, *V.D.E.-Fachber.*, Vol. 16, pp. II/8–13, 1952, in German.

Machine Drying

It was found that the dielectric strength of the insulation of a 27·8 MVA, 5·7 kV, A.E.G. turbo-generator working as a synchronous compensator was the same in a dry or in a damp condition. Sustained application of a voltage equal to 1·5 times the line voltage of the delta-connected generator did not produce any change in the insulation characteristics whether the windings were dry or wet. The ratio of the breakdown voltages (i.e., rectified to effective a.c. breakdown voltage) was in both cases about 2·2–2·3. The minimum breakdown voltages of the conductor bars in the front part of the winding for dry and damp insulation were never lower than 9·8 kV; those of the slot insulation were higher than 12 kV (a.c.). The application of a high a.c. voltage to a damp machine slightly accelerates the natural drying process, but tests as well as operational experience in power systems indicate that drying can be dispensed with in many cases when h.v. machinery becomes damp.—" Influence of Moisture on the Dielectric Strength of a Generator Insulation," N. N. Lukin and N. P. Fufurin, *Elekt. St.*, Vol. 23, No. 10, pp. 38–40, October, 1952, in Russian.

Magnetic Ferrite Cores

Magnetic ferrites are mixed crystals or compounds of iron oxide with one or several oxides of divalent metals, such as NiO, MnO, ZuO, MgO, CuO, etc. They differ from ferromagnetics by their high resistivity, which is of the order of 10^{2}–10^{7} Ω/cm, as against 10^{-5}–10^{-4} Ω/cm for metals. This makes their eddy current losses in alternating magnetic fields negligibly small, so that the losses of ferrite-cored oscillation or filter coils will be much smaller than those of metal-cored coils. Nor will it be necessary to laminate ferrite cores. However, although the initial permeability of some ferrites is very high and, at low frequencies, almost frequency-independent, it falls steeply at the Curie temperature. Also, the Curie temperature for any ferrite is lower, the higher its initial permeability.

For reasons of thermal stability ferritic cores of comparatively low initial permeability are preferable. Then, the permeability of ferrites falls considerably from frequencies of about 1 Mc/s onward, and very nearly in the inverse ratio of the frequency. For this reason the impedance

of a ferrite-cored coil remains nearly constant above 1 Mc/s and therefore these coils are suitable for wide-band transmitters or repeaters. Other types of ferrites form ideal core material for loading coils. A great deal of valuable specialized information is collected in the article.—" Magnetic Data on Ferrite Cores," M. Kornetzki, *V.D.E.-Fachber.*, Vol. 16, pp. I/6–12, 1952, in German.

Transformer Calculations

The iron section of transformers is usually determined by formulæ which do not take into consideration the short-circuit voltage. However, this is one of the values prescribed when a transformer is ordered and actually there is a convenient way, as shown by the author, of finding the iron section from output, operating and short-circuit voltage. If the copper losses are also prescribed, these together with the short-circuit voltage may be used for determining the leakage voltage; otherwise, the copper losses have to be assumed. Furthermore, the dimensions of the window are determined. A simplification of the calculation is obtained by the introduction of the proportionality factor λ (ratio of average winding length to length of the leakage lines). A comparison of the results of the new method relating to a 25 MVA transformer with the results obtained by one of the conventional methods shows the possible saving on materials and reduction of losses.—" Calculation of a Transformer for a given Short-Circuit Voltage," N. Hammerl, *E.u.M.*, Vol. 70, No. 2, pp. 25–29, 15th January, 1953, in German.

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates. —Editors, *Electrical Review*.

SOUTH WALES BOARD AND CONTRACTORS

LAST week we reported the annual conference and dinner of the Liaison Committee of the South Wales Electricity Board and the Electrical Contractors' Association. We now reproduce a photograph of Mr. L. Howles, C.B.E., who was accompanied by Mr. R. L. Booth, chairman of the E.C.A. South Wales Sectional Board, opening the conference. Mr. Howles spoke of the successful operation of the liaison scheme which had enabled the few complaints which had arisen to be dealt with satisfactorily. At the dinner which concluded the proceedings Mr. Howles proposed " The Electrical Industry " and presented an optimistic picture of electricity supply conditions in South Wales. Various difficulties were being rapidly overcome and they looked forward to the time when it would be possible to concentrate on development. Responses were made to the toast by Mr. W. J. Creemer (W. J. Creemer, Ltd., Cardiff) and Mr. I. G. Evans, the Board's West Central Sub-Area commercial officer.

Mr. L. Howles opening the South Wales conference. With him is Mr. R. L. Booth (E.C.A.)

Higher Management Lectures

THE London Centre of the Institute of Industrial Administration is holding a series of higher management lectures on Wednesdays 13th, 20th and 27th May and 3rd and 10th June in the Fyvie Hall, Regent Street Polytechnic, W.1. The title of the series is " Measuring Efficiency—the Management Audit." The fee for the whole course is £2 2s and for single lectures 10s 6d each. Applications for tickets should be made to Mr. H. A. Butler, hon. secretary of the London Centre, 3, Marbans Gardens, Eastcote, Pinner, Middx.

Conducting Films on Glass

Deposition by Cathodic Sputtering

BECAUSE of the danger of the pilot's view may be obscured through icing up, attention is being devoted to the problem of heating the windows of aircraft. A possible method by which this could be achieved is by coating the glass with a transparent film which is an electrical conductor. Both in Great Britain and the United States research workers have succeeded in developing processes for depositing improved electrically conducting films on glass. The most suitable British film is slightly less transparent than the American product, but its electrical resistance is so much lower that considerably reduced voltages can be used for heating purposes, while Britain also has the advantage of a process which is capable of quite accurate control in production. It has not yet been tried out on a large scale, but there seems to be no reason why it should not be suitable for commercial production.

Soon after the war American workers announced the development of a process which consisted of heating a sheet of glass almost to the softening point and, in that condition, spraying it with a solution containing chloride of tin. The film left on the glass was presumably tin oxide, which in its normal form as a pure white powder is not usually regarded as an electrical conductor. The chief disadvantages of this process are the risk of breakage while the hot glass is being sprayed and the difficulty of producing a uniform thickness of film. These drawbacks resulted in a high proportion of rejects and the coated glass was therefore expensive to produce.

N.P.L. Method

The announcement of the American discovery came at a time when the Light Division of the National Physical Laboratory, for entirely different reasons, was also concerned with films which could be used for conducting and heating. The Division's interest in this subject arose from work which had been in progress for several years on the selenium barrier layer photocell. In the production of the light-sensitive discs used in photography for exposure meters, a film which is electrically conducting and not opaque to light must be deposited on top of a layer of selenium. This requirement led to the discovery of a method of producing thin films of cadmium oxide, which resembled the American tin oxide films in two important respects, namely, that the transmission for white light was about 80 per cent and that the electrical resistance was 100 ohms between opposite sides of a square. The chief points of difference were that the cadmium oxide film was slightly tinged with yellow and that it was much softer mechanically and more liable to chemical attack. Though suitable for covering glass, it must be protected from the elements because it is easily damaged. A further drawback is that it can only withstand a temperature of about 80–100 deg C whereas the American film can stand several hundred degrees.

Description of Process

The process used at the N.P.L. is known as cathodic sputtering. A circular disc of the appropriate metal is placed in a vacuum chamber. The air is pumped out and replaced by argon gas at a suitable low pressure, a continuous flow of argon being maintained. A voltage of perhaps 1,000 V d.c. is applied between the disc and wall of the chamber, the former being the negative electrode. Bombardment of the disc by the ionized argon causes the metal disc to dissolve very slowly in a manner similar to vaporization. If the article to be coated—for example, a sheet of glass—is positioned in the chamber at a convenient distance from the disc the vapour will condense on its surface as a metallic film, the rate of deposition depending on the current through the discharge. If a suitable trace of oxygen is added to the argon in the chamber, a film of the oxide (not of the metal itself) will be obtained in certain cases, e.g., when cadmium is used as the disc. This particular variation of the general process is the subject of several

industrial patents. Being independent of heat and also of chemical reactions with their attendant hydrochloric acid fumes, the sputtering process has important advantages over the American method.

Films of metallic oxides can also be made by an alternative process which has been known for many years. A thin film of the actual metal is deposited by any suitable method and is then heated to a temperature slightly below its melting point and held at that temperature. In the case of a number of metals which tarnish readily, the thin metallic film will combine with oxygen from the atmosphere to form a film of the oxide.

Further Experiments

Early in 1951 experiments were started at the N.P.L. in order to extend the range of oxide films which could be produced by the sputtering process, either directly or by subsequent heating of the sputtered metal film. Quite a large number of oxides were produced but, apart from the cadmium oxide previously mentioned, none of them combined good transparency with a sufficiently high electrical conductivity to be of practical value. Nevertheless, the investigators succeeded in producing a film of tin oxide with the same chemical and mechanical properties as the American product, but thinner and with an electrical resistance of the order of 2,000–3,000 ohms " per square." Further experiments were carried out with the object of lowering the resistance of the tin oxide and this work was still in progress when the investigators were suddenly presented with a more urgent problem. The N.P.L. was approached by the Ministry of Supply, which was anxious that a suitable alternative to the American product should be developed as rapidly as possible for use on British aircraft. Apart from the desirability of conserving dollars, the Ministry expressed a preference for a coating with a lower electrical resistance.

Instead of going on trying to produce an improved tin oxide it was decided to examine the possibilities of sputtered metallic films. Gold films seemed to offer the most promising starting point because gold has a very low electrical resistance and is chemically inert, so that the films it produces are not easily damaged by tarnishing. Calculations based on the properties of solid gold indicated that a film thin enough to transmit 70 or 80 per cent of light should have an electrical resistance of only a few ohms " per square." On the other hand, films of this thickness which had previously been made by other workers had final resistances of the order of 100 ohms " per square " or even greater. The accepted explanation was that those gold films were not continuous, but granular.

The next step, therefore, was to find out whether the sputtered film could be modified to make it more continuous, or more regular in structure. Experiments showed that the result obtained depended to a large extent on the manner in which the gold was deposited and also on the state of the surface. The electrical conductivity was even influenced by different methods of cleaning the glass. The investigators were unable to obtain values of the desired order and difficulty was also experienced in obtaining consistent results with the same thickness of coating. The effects of depositing thin layers of gold on a number of oxides previously deposited on glass were next examined. It was soon found that if the base material was one of certain oxides, such as lead or bismuth oxide, the resistance was much lower than that of any film produced by direct deposition on glass and the coated film was also much more transparent.

Heating Effects

Examination of the effects of heating showed that when such a film was held for a few minutes at 200 deg C, its electrical resistance was permanently lowered by a factor of about two. For example, gold on bismuth oxide would have a final resistance " per square " of 10 ohms and a transmission of white light of just under 75 per cent. This result is typical of the development work so far carried out on this type of film, but a few minor modifications have been introduced. Owing to the softness of gold it has been found necessary to protect the film by laminating a cover glass over it. The lamination raises the transmission to over 75 per cent by optical effects. Another possibility is that a second oxide film might be deposited over the gold film, thus providing a considerable degree of mechanical protection at the expense of a 1 or 2 per cent loss in light transmission.

The films associated with the gold processes are both about a quarter of a mil[lionth]

of an inch thick. The thickness of the oxide film is immaterial, but that of the gold is critical because it influences both the transparency and the electrical resistance. This type of film, with or without a protective oxide coating, is likely to be generally used, but it is possible that the transmission might be improved. By using two oxide films of controlled thickness one above and the other below a metal film, the reflection and absorption are reduced and the transmission can be increased to slightly over 60 per cent.

The resistance of the British product is so low that it is almost possible to envisage the heating of a motor car windscreen directly from a 12 V battery instead of from a separate high voltage generator on the car, which is necessary in the case of the American product. In the aircraft industry insulation problems should be considerably eased by the lower voltage which has now become a possibility.

The sputtering method produces gold films about a quarter of a millionth of an inch thick in about five seconds with a current of 0·1 A, the diameter of the gold disc being about $3\frac{1}{2}$in as used in the experimental plant. The cost of the raw materials is negligible, even that of the gold amounting to only about 1d/sq ft at current prices. Nevertheless, the fact that the coated material will in general have to be a laminated sheet will of itself make the coated product more expensive than plain glass.

Energy Dissipation

Mr. J. S. Preston, the N.P.L. officer in charge of the investigation, points out that the use of this material to coat glass in aircraft for the dispersion of snow and ice might well require the dissipation of some hundreds of watts per sq ft of glass surface. This requirement raises the question of how to attach satisfactory busbars along the edges of the window for use as electrodes which will ensure even distribution of current flow and power dissipation over the whole area of the window. For measuring resistance and power dissipation in the laboratory, suitable busbars have been provided by depositing thicker gold films along two opposite edges of the specimen and thickening them still further with a deposit of sprayed metal. This technique would hardly be suitable for practical application, however, because it is not cheap and the necessary degree of adhesion of the busbars to the glass is not achieved.

Another consideration which will doubtless have to be taken into account is the maximum temperature at which the film itself will operate without damage. In the case of a laminated window it is obviously necessary to ensure that the temperature will not rise above the degree at which the plastic material of the lamination begins to soften; hence a temperature-sensitive control element will in many cases have to be incorporated in the window itself. Further technological study will thus be necessary before one can finally judge the sphere of usefulness of the material, or the maximum dissipation of energy which will be possible in certain circumstances.

Laboratory Test Results

In the laboratory test samples of gold films, whose temperature was maintained below 80 or 90 deg C by immersion in running water, have been operated continuously for a week without failure at an electrical loading of 3 kW/sq ft. It is for other investigators to find the maximum continuous safe loading under ordinary working conditions and what type of circuit can best be used for thermostatic regulation to eliminate the danger of overheating.

Apart from the potential value of this development to aviation there are indications that the usefulness of certain types of conducting glass as windows for certain delicate electrical instruments is now being recognized. The glass is liable to become "electrified" by frictional rubbing when being cleaned, so that it attracts the pointer and a faulty reading results. Such static charging could be avoided if the inner surface of the glass were covered with a film which was sufficiently conducting to allow the electrical charge to be dispersed.

The electrical conductivity required for this particular application is fairly low, while the tolerances on resistance are quite wide. Since the requirements are not stringent, it seems possible that the material might be produced at a relatively low cost compared with the whole cost of the instrument. Either the cadmium oxide or the tin oxide film produced by the N.P.L. process would be quite suitable for this purpose, the latter being preferred because of its greater resistance to chemical effects.

It is also conceivable that, if their resistances were stable enough, the oxide films

might be used in the production of fixed resistors, such as radar components, which might consist of strips of glass coated with these materials. Electrically conducting films might also be used for various vacuum devices, such as the fluorescent lamp or the mercury-in-glass rectifier, in which cases it is an advantage to have certain parts of the inner surfaces of the glass envelope partly conducting. For many such cases, however, transparency of the film is not of any consequence, so the range of potentially suitable materials is therefore much wider.

Lloyd's Register

DURING 1952 the total number of ships completed to the classification of Lloyd's Register of Shipping was 524 with an aggregate gross tonnage of 2,522,941, representing 60 per cent of the total tonnage built during the year throughout the world. At the close of the year 595 ships (3,847,000 tons gross) were under construction. Also being built to the Society's classification were over 700 sets of marine engines (about 3,350,000 s.h.p.) and 570 electrical installations of about 200,000 kW capacity.

An analysis of world tonnage according to propulsion systems shows that of a total gross tonnage of 90,180,359 in 1952 5,128,560 tons was turbo-electric and 199,219 diesel-electric.

Among the points in Lloyd's report for 1952 is a reference to the more general adoption of electric welding in ship construction. This, it is said, requires close attention from the surveyors, both in the examination of plans and supervision of construction. Departments in the head office now deal with some 13,000 hull plans a year. Initial steps have been taken towards the formulation of rules for the welding of aluminium alloys in ship construction. In association with the British Shipbuilding Research Association and the British Welding Research Association a series of tests on welded aluminium joints has been undertaken.

Since the Committee's decision to require parts of primary structural importance over 1in thick to be of special quality steel, the principal steel mills in the United Kingdom, as well as many Continental and Japanese works, have received approval for steel specifications under the provisions of this rule.

A growing preference is being shown for a.c. electrical systems, particularly in tankers. The tendency appears to be to standardize on 440 V three-phase 60 c/s. In recent months 50 per cent of the total kW of generating plant for new ships has been a.c., whereas only a few years ago an a.c. installation was almost unknown.

The revised Chapters L and M (Electric Propelling Machinery and Electrical Equipment) have been approved by the Committee as Unified Rules.

The many requests for the services of specially trained engineer-surveyors to supervise the inspection of large-scale site projects have necessitated the appointment of a number of specialists for this class of work. A power station and water distillation plant for the Sheik of Kuwait are under the Society's inspection. Other site commitments include work on two atomic energy plants, some British wind tunnels and irrigation and water-power schemes for the Iraq Government.

Considerable expansion in the volume and importance of survey work in connection with electrical projects has taken place during the past twelve months. The Society continues to act as the official inspector for the Hydro-Electric Power Commission of Tasmania. Since 1940, when Lloyd's Register took over this work, the installed capacity in Tasmania has increased from 104,500 to 293,000 kW.

Another hydro-electric contract for which the Society will survey all the materials and plant is that for the new station at Sariyar, Turkey. The electrical and mechanical equipment for the new coalfields in the Zonguldak area of Turkey will also be constructed under the Society's survey. The surveyors are at present supervising the whole of the work on two 30 MW water turbines for the Snowy Mountain hydro-electric and irrigation scheme in Australia.

COMMERCE and INDUSTRY

Engineering Wages Claim

REPRESENTATIVES of the 38 organizations affiliated to the Confederation of Shipbuilding and Engineering Unions at a meeting in London last week decided to recommend their unions to lodge a claim for an increase of 15 per cent in the wages of all members. This represents a rise of about £1 a week for skilled adult male workers and about 17s 6d for unskilled men. The unions are to consider the matter and a final decision will be taken at a representative meeting at York on 20th May. On Monday Mr. J. Tanner, president of the A.E.U., announced that the Executive Council supported the recommendation.

Electricians' Holidays

It was announced a short time ago that the Electrical Contractors' Association had agreed in principle to the award of two weeks' paid holiday for operatives to whom the N.F.E.A./E.T.U. agreements applied. It has now been agreed that the arrangement shall start with the 1954 holidays for which contributions under the card-and-stamp commence on 1st June next. In making this announcement Mr. L. C. Penwill, director and secretary of the E.C.A., says that there will also be radical changes in the adult holidays with pay agreement.

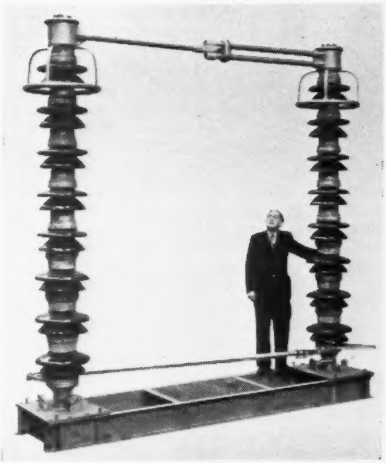
New Zealand Tariff Inquiry

The New Zealand Board of Trade is to hold a public inquiry on 30th July to receive evidence in connection with the tariff rates on electric irons and ironing and clothes pressing machines. Notes for the guidance of witnesses preparing evidence for the inquiry are available from the Commercial Relations and Export Department, Board of Trade, Room 6150, Horse Guards Avenue, London, S.W.1 (telephone: Trafalgar 8855). Statements of evidence have to be lodged with the Secretary of the N.Z. Board of Trade by 16th July.

A 275 kV Isolator

An isolator for 275 kV service has recently been designed jointly by the General Electric Co., Ltd., English Electric Co., Ltd., and Ferguson Pailin, Ltd., to meet the special requirements of the B.E.A.

The first of three manually-operated single-phase units of the new design has now been built by the G.E.C. and is being delivered to the B.E.A. cable testing station at Staythorpe.



First of three 275 kV isolators specially designed for the B.E.A.

The switch is of the rotary type with a central single break and is fitted with four-point high pressure contacts with a normal current rating of 1,200 A.

The G.E.C. has orders in hand for some 150 three-phase isolators for various B.E.A. sites throughout the country. Each consists of three single-phase units mechanically ganged in either a parallel or tandem group and arranged for both hydraulic and manual operation. The three-phase isolators will carry a through short circuit current corresponding to 7,500 MVA and certain of those now being made are fitted with manually operated earthing switches of the same short circuit rating.

"Nalgo" in 1952

Reviewing the annual report of the National and Local Government Officers' Association, *Public Service* (the Association's journal) says that during 1952 the Association played a major part in securing through the Industrial Court salary increases of between £8 and £20 for officers covered by the National Joint Council (Electricity Supply Industry). Other electricity supply matters with which it was concerned

were the negotiation of salary scales for typists, shorthand-typists and machine operators; the extension of the provisions for overtime payment; the improvement of the scheme of car allowances; and the remodelling of the National Joint Advisory Council.

British Radio for N.A.T.O.

A water-proof and bomb-blast-proof radio set that will work anywhere on any kind of electricity supply and will not burst at high altitudes is to be made for the N.A.T.O. forces in Europe by Thorn Electrical Industries, Ltd. The order has been received from the United States Army under the off-shore procurement programme in competition with seventy-five firms in Germany, France, Belgium, Holland, Italy and England.

Prefabricated Bungalows

A new form of prefabricated bungalow in traditional Canadian style is at present on show at the corner of South Parade and Chelsea Square, London, S.W.3. The bungalow, designed by Mr. F. Cubitt, F.R.I.B.A., is built with solid timber mansards, and the sections are held together by a new patented corner construction of simple design. The timber is pressure-impregnated to make it fire-proof and also proof against tropical insects or common termites. In co-operation with R. Nerdrum, Ltd., sole distributors of the bungalow, the British Electrical Development Association has provided complete electrical equipment for the light blue and cream finished all-electric kitchen. Among the electrical apparatus installed are a " Royal " cooker (Falco Electrical Appliances, Ltd.), a food mixer (English Electric Co., Ltd.), a table top model refrigerator (Pressed Steel Co., Ltd.), and a clock (Smith's English Clocks, Ltd.), while in the Canadian-type basement there are a washing machine (Parnall (Yate), Ltd.), and a refrigerator (Nash-Kelvinator). The bungalow has been opened for presentation to overseas buyers during the run of the British Industries Fair, but it is expected that it will remain open for some months for public inspection.

Electrical Housecraft Advisers

At the recent annual general meeting of the Association of Electrical Housecraft Advisers Dame Caroline Haslett, president, took the chair and 50 members were present. It was agreed that associate members should be admitted on certain terms. Applicants must be members of N.A.L.G.O.; they should already have begun their training to qualify for the E.A.W. certificate; and there would be a limit of three years to associate membership. During the meeting, Dame Caroline, on behalf of the committee, presented Miss Samuel with an electric blanket on her retirement from the industry. The meeting concluded with an address by the president, and a vote of thanks from the chairman of the Association, Miss M. S. Mitchell. Mr. Moser of N.A.L.G.O. answered many questions from the members after the meeting.

E.A.W. Area Conference

Members of the Midlands and East Midlands Branches of the Electrical Association for Women totalling 330 attended their area conference held in Newcastle-under-Lyme on 21st April. The Mayor and Mayoress of Newcastle with the Lord Mayor and Lady Mayoress of Stoke-on-Trent and the chairmen of the Newcastle and Stoke Branches of the E.A.W. received the delegates. Following the luncheon, Mr. D. H. Kendon, deputy chairman of the Midlands Electricity Board, proposed the toast to Newcastle and Stoke-on-Trent, which was replied to by the Mayor of Newcastle (in the chair), and the Lord Mayor of Stoke-on-Trent. Dr. Findlay, medical officer of health, maternity and child welfare, proposed the toast of the E.A.W. and Dame Caroline

The all-electric kitchen in the prefabricated Canadian-style bungalow

Haslett responded. Mrs. Boorman, chairman of the Newcastle Branch, proposed the toast of the guests, which was replied to by Alderman Bennett, Lord Mayor Elect, Stoke-on-Trent. Dame Caroline then opened a two-day exhibition, "Towards Perfection," which showed the developments in kitchen planning during the past fifty years.

Chief Joseph Dam Contract

There was a further development in the matter of tenders for generators and transformers for the Chief Joseph Dam, Washington, last week when new specifications were issued. These embody new clauses providing that the successful tenderers must enter into a 20 per cent "bid" bond and a 50 per cent "performance" bond, the latter being a safeguard against failure to comply strictly with the terms of the contract. It is believed that this will complicate matters for British tenderers. It will be recalled that the decision to issue new specifications was made after the English Electric Co., Ltd., had substantially underbid American manufacturers for the Chief Joseph contract.

Refrigeration Demonstrations

A successful "Refrigeration Week" was held recently at the Sutton showroom of the Surrey Sub-Area of the South Eastern Electricity Board in collaboration with Wall's Home Service. The latter provided the demonstrator and some publicity material and the event was supported by window and interior displays of refrigerators. Press advertising and posters. Invitations were sent to local women's organizations.

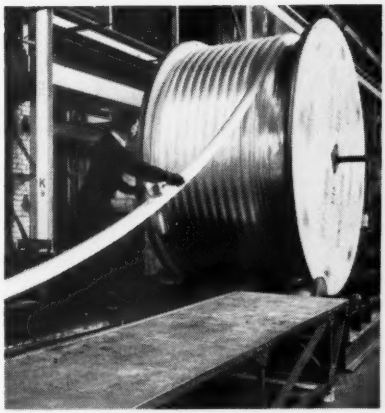
Completely different demonstrations were given each day under the general title of "Ice cream dishes for all occasions." A further series of six "Refrigeration Weeks" are being arranged for showrooms in the Surrey Sub-Area.

The Royal Yacht

The new Royal Yacht *Britannia* recently launched by H.M. The Queen was built to the requirements of the Admiralty by John Brown & Co., Ltd., Clydebank. Murex "Vodex" arc welding electrodes were extensively used for the welded work.

Large Aluminium Cable Sheathing

The accompanying picture shows the extrusion and coiling of a large aluminium tube that will be used to sheath a power transmission cable in Canada. Of 4¼in outside diameter, with wall thickness of 0·17in, it is claimed to be the largest aluminium cable sheathing tube ever produced, and it is supplied in 400ft lengths, unprecedented for a tube of this size. It is extruded by the Northern Aluminium Co., Ltd., on an 8,000 ton Fielding press. As it emerges from the press, each length of tube is coiled on to a drum 12ft in diameter and 6ft wide, with a barrel of 10ft diameter. Twenty lengths of the tubing have been ordered for sheathing a paper-insulated hollow segmental aluminium conductor that is to operate at 300 kV. This cable will transmit power from the generators in a power station built inside a mountain of the Coast Range near Kemano, British Columbia, to supply the smelter that the Aluminum Co. of Canada is now building at Kitimat. The diameter of the conductor to be sheathed is 3¾in and that of the finished cable, after the tube has been sunk on to it, is about 3·85in.



Coiling the cable sheathing tube straight from the extrusion press on to the drum at the works of the Northern Aluminium Co., Ltd.

Birmingham Electric Club

The annual outing of the Birmingham Electric Club will be held on 28th May when a visit will be made to the Harworth factory of Glass Bulbs, Ltd. Lunch and tea will be served at the works. The cost of the outing will be 35s for each member attending and will include morning coffee, dinner on the return train, coach and train fares. Applications should be made to Mr. J. Clement, hon. social secretary, 33, Elmdon Road, Birmingham, 29.

Coal Preparation Plant Contract

A contract has been placed with the Fraser & Chalmers Engineering Works of the General Electric Co., Ltd., by the National Coal Board for a coal preparation plant to be installed at Cwm Colliery in the No. 3 (Rhondda) Area of the South Western Division. The plant to be supplied will deal with two different grades of coal and comprises two separate units each capable of dealing with an input of 200 tons hr. Each section includes a "Chance" washer and the froth flotation and water clarification units. The refuse from both sections is fed to

a common plant where it is crushed and then screened for underground stowing. The contract also includes the interconnecting raw coal and refuse conveyors and bunkers, together with a 25-ton Fraser & Chalmers "Marshall" wagon tippler for handling any foreign coal. All motors and starters for the machinery, lighting services and heating for the building are also included in the contract.

Wireless and Electrical Year Book

The 1953 edition of the "Wireless and Electrical Trader Year Book" includes condensed specifications of current 1953 commercial television receivers and information on valve and cathode-ray tube base connections, with over 200 valve base diagrams.

A re-introduced feature is the mains voltage directory for all the principal towns in Great Britain. Other sections are a comprehensive list of the I.F. values of commercial radio receivers marketed during the past five years, specifications of current radio receivers, legal information and a directory of trade associations. Directory sections are printed on distinctively tinted papers for ease of reference.

The Year Book (264 pp.) is published at 10s 6d (postage 6d) (with a reduction to subscribers to *Wireless and Electrical Trader*) by the Trader Publishing Co., Ltd.

"English Electric" Domestic Appliances

As from 1st May the Domestic Appliance Division of the English Electric Co., Ltd., is transacting business directly with the electrical retail trade, and has discontinued distribution of its products through wholesalers. This new system applies throughout Great Britain but not to Northern Ireland and the Channel Islands. A special campaign book is being circulated among authorized "English Electric" dealers, which describes the various forms of advertising and sales promotion activities undertaken by the company. Two new services are announced: regional sales training schools which will be organized by Mr. J. C. Andrews of the Domestic Appliance Division, and a demonstration team headed by Mrs. M. Pearce, senior housecraft adviser. New publications include a sales training and instruction manual, a demonstrator's bulletin, five attractive new leaflets covering the range of appliances, and a colourful "food mixer" cookery book. This new policy affects only products handled by the Domestic Appliance Division. Arrangements for the distribution of television receivers remain unchanged.

Part of the new Nottingham showrooms of Falk, Stadelmann & Co., Ltd.

Prices of Materials

In the accompanying table we give the prices of the more important materials used in the electrical industry. The figures are those quoted on Monday last.

ALUMINIUM Ingots	ton £161 0s 0d
COPPER, H.C. Electro	ton £253 0s 0d
Fire Refined 99·70 per cent ..	ton £252 0s 0d
Fire Refined 99·50 per cent ..	ton £251 0s 0d
COPPER Tubes	lb 2s 6½d
Sheet	ton £3 6 10s 0d
H.C. wire and strip	ton £282 15s 0d
LEAD, English	ton £78 10s 0d
Foreign	ton £77 0s 0d
MERCURY	flask £70 10s 0d
TIN	ton £727 0s 0d
ZINC, G.O.B. Foreign	ton £66 0s 0d
Electrolytic	ton £67 10s 0d
BRASS Tubes	lb 2s 1d
Sheet	ton £241 0s 0d
Wire	lb 2s 6¼d
PHOSPHOR BRONZE	
Wire	lb 3s 9½d
RUBBER, No. 1 R.S.S. spot ..	lb 22¼d–22½d

Falk's Nottingham Showrooms

The Nottingham Branch of Falk, Stadelmann & Co., Ltd., has been moved to larger premises at 1, Kaye's Walk, off Stoney Street, Nottingham. On 21st and 22nd April a number of trade friends and customers attended an informal opening. A section of the new showrooms is shown in the accompanying illustration.

Oil Engine Prices Reduced

At a Press conference in London last week Mr. Robert Lister, a director of Blackstone & Co., Ltd., announced price reductions applicable to the home market of 25 per cent on its entire range of industrial oil engines. This follows a price reduction of 4½ per cent made by the company on its vertical and horizontal oil engines in January this year. He said that as far as the vertical engines were concerned the reduction would vary from £55 to nearly £2,000. Since the war 96 per cent of their business had been in export markets. Those markets were not what they were due

to world monetary conditions) and the company were turning their attention much more to the home markets.

Bristol Cooking Demonstration

Nearly 4,000 people from Bristol and the neighbouring towns of Weston-super-Mare and Bath attended two cooking demonstrations given recently by Mr. Philip Harben at Colston Hall, Bristol. The demonstrations were arranged by the South Western Electricity Board, which also arranged a competition open to those who attended the demonstrations. Competitors were asked to complete the sentence "Electricity is the housewife's best friend because . . ." by adding fifteen additional words. Prizes of an electric cooker and ten electric irons were offered. The entries will be judged by an independent panel.

Batti-Wallahs' Society

The editorial side of publishing formed the subject of an interesting address given by Mr. J. A. White, managing director of Methuen & Co., Ltd., at last week's luncheon of the Batti-Wallahs' Society.

Induction Heating Exhibition

In conjunction with Delapena & Son, Ltd., the Birmingham and District Sub-Area of the Midlands Electricity Board is giving a demonstration of induction heating equipment in its industrial showroom at 247, Chester Street, Aston, Birmingham, 6, from 11th to 15th May.

Refrigerator Display Competition

Prestcold Refrigeration (Pressed Steel Co., Ltd.) is holding a window display competition, which commenced on 4th May and continues until 16th May, in which cash prizes are offered for the best window displays of Prestcold refrigerators. There are three classes, Electricity Board showrooms, departmental stores and electrical dealers. Prizes of £100, £30 and £20 are offered in each class with five extra merit prizes of £10 each.

Advertisement Correction

In the advertisement of Dimplex, Ltd., in our issue of 24th April (p. 44) the company's flameproof radiators were said to be made for voltages of 111, 200/220 and 230/250; the first figure should have been 110. Also, the gas-tight models are made for 110 V as well as 200/220 V and 230/250 V.

Diesel-Electric Shunting Locomotives

British Railways have ordered the power equipments for 85 diesel-electric shunting locomotives which are to be built in 1954 and 1955. This is an instalment of the 1953–1957 programme which includes 573 diesel shunting locomotives. The contracts are for 45 equipments from the English Electric Co., fitted with engines of its own manufacture; 15 equipments each from the British Thomson-Houston and the General Electric Companies, with Blackstone engines; and 10 from Crompton Parkinson, with Crossley engines. The main frames, wheels, cab structures and mechanical parts of these locomotives will be manufactured and erected at the British Railways workshops at Darlington and Derby.

Trade Announcements

The **Carlin Engineering Co., Ltd.,** has moved to 36, Maiden Lane, Strand, London, W.C.2 (telephone : Temple Bar 9537).

The Scottish address of **Decca Radar, Ltd.,** and the **Decca Navigator Co., Ltd.,** is now 67, Blythswood Street, Glasgow, C.2 (telephone : City 6457). The manager for Scotland is Mr. R. E. G. Simmons.

A new branch has been opened by **Rich & Pattison (B'ham), Ltd.,** at 38, Ford Street, Coventry (telephone : 5946), under the managership of Mr. A. A. Peters. Facilities include showrooms and a trade counter.

The **Association of Steel Conduit Manufacturers** has moved to 96, Hagley Road, Edgbaston, Birmingham, 16 (telephone : Edgbaston 4148/9 and 4140).

The registered office and works of the **Warm-Glow Co., Ltd.,** are now at Progress Road, Leigh-on-Sea, Essex (telephone : Eastwood 55742).

Catalogues and Lists

Drake & Gorham (Wholesale), Ltd., 77, Long Acre, London, W.C.2.—48-page illustrated catalogue covering domestic and industrial appliances, together with price list (617).

London Fan & Motor Co., Ltd., 91a, Burghley Road, Tufnell Park, London, N.W.5.—Four-page leaflet illustrating the latest range of "Breeza" and "Trojan" fans.

International Combustion, Ltd., 19, Woburn Place, London, W.C.1.—Catalogue relating to the "Raymond" range of laboratory equipment including operating instructions (G.534).

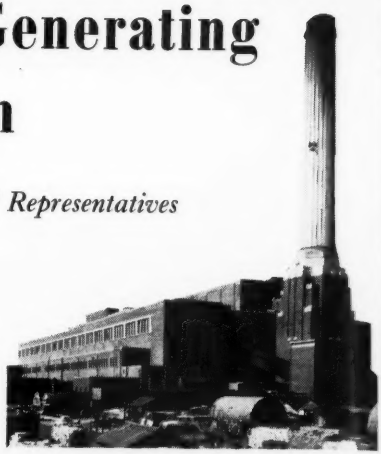
The Belmos Co., Ltd., Bellshill, Lanarkshire.—Descriptive catalogue illustrating a range of flameproof and industrial switchgear and motor control gear.

M.K. Electric, Ltd., Wakefield Street, London, N.18.—Illustrated leaflet covering complete range of B.S. 1363 plugs and sockets.

Ferranti, Ltd., Hollinwood, Lancs.—Illustrated brochure containing a survey of the Ferranti Foundry with some examples of its products.

Brighton "B" Generating Station

Visit by Civic and Industrial Representatives



FOUR months ago the first set in Brighton "B" generating station was commissioned, and on Wednesday last the occasion was marked by a "house warming" party, which was attended by members of local authorities in the area and representatives of the various firms responsible for the construction of the station. Sir Henry Self, deputy chairman (administration) of the B.E.A., referred to the great part played by the Brighton Corporation in the inception of the station. In October, 1946, the Corporation voted £15 million for the project and the first pile was driven into the site in 1947. Sir Henry also mentioned the contributions of the late Sir Herbert Carden, Mr. W. N. C. Clinch, borough electrical engineer, and his successor, Mr. H. Pryce-Jones.

View of turbine hall from crane

The constructional details of the station were described in the *Electrical Review* of 15th June, 1951, p. 1238, by Mr. W. C. Parker, divisional controller, South Eastern Division. The station will ultimately house four 52·5 MW sets and two 60 MW sets, together with twelve 320,000 lb/hr boilers arranged for pulverized fuel firing, thereby making a total installed capacity of 330 MW. The first 52·5 MW set was commissioned in December, 1952, and by the end of this year three sets will be in operation. Number four set is expected to be commissioned in 1955 and the final two 60 MW sets will probably be put into service during the period 1957–58. The civil engineering works for the first four sets have already been completed.

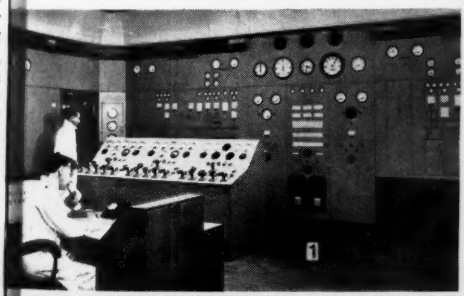
The sets are arranged longitudinally with the boiler houses running parallel with the turbine room. A non-basement construction is employed with all operating points, as far as possible, on the same level. A store is provided for about 100,000 ton of coal which will be delivered by sea. About £2,000,000 is being spent on Shoreham Harbour, but this is not entirely for the benefit of the generating station.

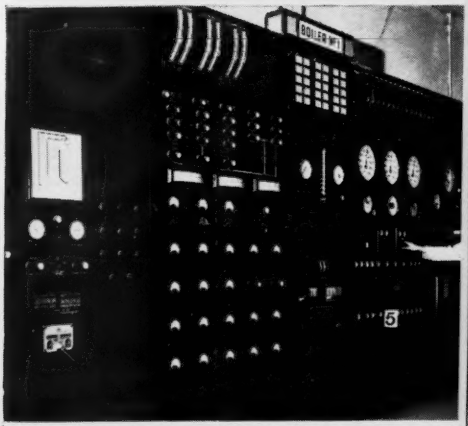
The steam conditions are stop valve pressure 900 lb/sq in normal and 950

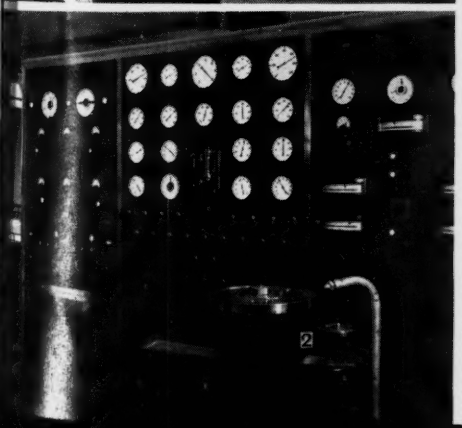
lb sq in maximum, stop valve temperature 900 deg F normal and 925 deg F maximum. The final feed temperature is 385 deg F and vacuum 29in mercury at maximum continuous rating. The turbines are of the impulse-reaction type with three cylinders and they operate at 3,000 r.p.m. The numbers of stages in each cylinder is: h.p. one impulse and 24 reaction, i.p. 19 reaction, l.p. double-flow, each half having 6 reaction switches.

Each alternator, which is air cooled, generates at 11·8 kV with a power factor of 85 per cent and is solidly connected to a 11·8/141·5 kV step-up transformer. Each turbine exhausts to twin two pass condensers having a total surface of 50,000 sq ft. Two boilers with an m.c.r. of 320,000 lb/hr and an economic rating of 280,000 lb/hr are provided for each turbine. They are pulverized fuel fired and the combustion chambers are suitable for North-East Coast or East-Midland coal. The boilers are fitted with automatic control and automatic sequence operated soot blowers. They are fitted both with mechanical grit arrestors

(1) Main control room. (2) Turbine control panel, (3) Coal hoppers. (4) Pump house. (5) Boiler control panel. (6) View of boilers







and electrostatic precipitators which will have a combined efficiency of 99 per cent.

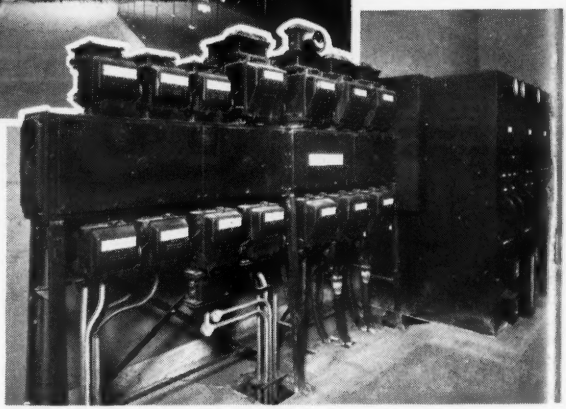
The principal contractors for the station are: Richardsons, Westgarth & Co., Ltd., turbo-alternators; Babcock & Wilcox, Ltd., boilers and ash and dust handling plant; Holloway Bros. (London), Ltd., piling, substructure and superstructure; Redpath, Brown & Co., Ltd., steel work; Bierrum & Partners, Ltd., cooling water culverts and coal wharf; English Electric Co., Ltd., generator transformer and switchgear; Metropolitan-Vickers Electrical Co., Ltd., auxiliary transformers and switchgear; Pirelli-General Cable Works, Ltd., 132 kV and 33 kV cables; Mitchell Engineering, Ltd., coal handling plant; Gwynnes Pumps, Ltd., harbour pumps; C. A. Parsons & Co., Ltd., h.p. pipe work; Permutit, Ltd., chlorinating plant; Troughton & Young, Ltd., l.v. cables; Brightside Foundry & Engineering Co., Ltd., l.p. pipe work; and Sturtevant Engineering Co., Ltd., electrostatic precipitators.

STEELWORKS EQUIPMENT

WE have received the following information relating to electrical equipment supplied by the English Electric Co., Ltd., in connection with the extensions at the works at Shotton of John Summers & Sons, Ltd. (see last week's issue, p. 979). For the blast furnace supply there are two 750 kW, 240 V rectifier equipments, operating from a 6·6 kV supply, and each of these contains three cubicle-mounted air-cooled pumpless steel rectifiers, an outdoor transformer and a separately-mounted triple frequency transformer for d.c. no-load voltage control. The main 240 V d.c. distribution switchboard has nine panels, and there are eight class OB circuit breakers, with current ratings ranging from 4,000 A to 600 A. For the main incoming supply there are two 1,000 kVA and four 750 kVA 6,600/440 V outdoor type transformers.

The extensions at Shotton also include 20 distribution boards made by the company, including 17 440 V a.c., class OB/CFS boards and three 240 V d.c. boards. The English Electric Co. also supplied 1·5 h.p. geared motors for the goggle valves and 15 h.p. motors for the sinter machine.

Above: **D.c. switchboard controlling output from rectifier plant (left)**



Below: **Combined air circuit breaker and fuse switchboard controlling l.v. supply to furnace plant**

Surface Waves

Results of Recent Investigations

WORK on surface waves is being conducted at University College, London, some of which was described in two papers which were presented at a recent meeting of the Radio Section of the Institution of Electrical Engineers in London.

Cylindrical Form

The first, "An Investigation of the Characteristics of Cylindrical Surface Waves," by Professor H. M. Barlow and A. E. Karbowiak, dealt with some quantitative measurements on cylindrical surface waves at 10,000 Mc/s. For this purpose an axial standing-wave indicator and an instrument for determining the radial field distribution have been designed and tested by application to a wave of known configuration. The former was used for simple impedance measurements and is now established as a practical device.

Quantitative observations on cylindrical surface waves, made with the other instrument at a long distance (30ft) from a launching horn, agreed with theory. With thin bare copper wires and enamelled wires of small size the radial decay coefficient deduced from the field-distribution graph approximated closely to the value obtained from the Sommerfeld-Goubau theory. However, the field distribution near the horn was always considerably distorted by radiation from the horn.

For accurate work in the limited space available, it was found necessary to dispense with the horn and set up a surface-wave resonator. This arrangement is capable of yielding the same information on field distribution, since the standing-wave and travelling-wave patterns are identical. The wavelength of the surface wave supported by the resonator at its resonant frequency was measured by a special method described in the paper, and from a knowledge of the resonant frequency the decay coefficient was calculated.

Measurements on 24 s.w.g. copper wire thickly coated with polythene showed that the corresponding values of the decay coefficient derived from the Goubau theory were greatly in error. This applied in particular to conductors having a coating of polythene more than 0·010in thick. A curve relating the coating thickness with the measured decay coefficient was obtained and compared with the Goubau predictions. Later the assumptions made in the original theory were revised, and accurate curves displaying the dependence of the decay coefficient on the thickness of dielectric coating, wire diameter and frequency were computed. These curves agreed with the experimental results. The surface-wave resonator can also be used for the measurement of surface reactance of corrugated surfaces.

Wave Theory

The second paper, "Surface Waves," by Professor H. M. Barlow and Dr. A. L. Cullen, is an attempt to present, in the simplest terms, a unified picture of the theory of various forms of surface waves and a clear physical interpretation of their behaviour.

The Zenneck wave, the radial cylindrical surface wave and the Sommerfeld-Goubau or axial cylindrical surface wave are discussed and are shown to represent basically one and the same phenomenon. The link with the Brewster angle, for which a wave incident on a surface suffers no reflection, is clearly established. The transition from a TEM (transverse electro-magnetic) wave supported by a parallel-strip transmission line, with metal plates near one another, to two Zenneck waves independently supported by the plates, when these are separated by a very large distance, is demonstrated.

The effect of bends in the supporting surface is considered and methods of reducing radiation are explained. Finally, the principles governing the launching of surface waves are surveyed with particular reference to the Brewster-angle approach.

ELECTRICITY SUPPLY

Proposed Ferrybridge "B" Power Station

Large Scottish Distribution Scheme

THE British Electricity Authority has received the consent of the Minister of Fuel and Power to the establishment of a new section of the Ferrybridge power station, Yorkshire, to be known as the Ferrybridge "B" station. It will have an installed capacity of 300 MW made up of three 100 MW turbo-generators each served by a 755,000 lb hr boiler unit. The existing station has an installed capacity of 170 MW. Three cooling towers, each having a capacity of four million gallons of water an hour, will serve the new section.

B.E.A. Contracts

Contracts have been placed by the British Electricity Authority during the past month for power stations, transforming stations and transmission lines amounting in the aggregate to £4,651,347. The principal contracts include the following:—

Brunswick Wharf power station, Poplar: Circulating water pipework.—Aiton & Co. Auxiliary cables and connections.—London Electricity Board.

Tilbury station: Two generator transformers.—English Electric Co.

Ince station, nr. Ellesmere Port: Superstructure.—Holland & Hannen and Cubitts.

Skelton Grange station, Leeds: 11 kV and lower voltage cables and accessories.—Drake & Gorham (Contractors).

Stella North station, nr. Newcastle-upon-Tyne: Three reinforced concrete cooling towers and ancillary works.—Davenport Engineering Co.

Stella South station: Two brick chimneys.—P. C. Richardson & Co.

Chadderton station, Oldham: Structural steelwork.—Edward Wood & Co. Power, control and indication cables for two turbo-alternator sets.—Enfield Cables.

Huncoat station, Accrington: Brick chimney.—P. C. Richardson & Co. (Middlesbrough).

Wymondley substation, Herts: 132 kV 1,500 MVA switchgear.—English Electric Co.

Crumlin, Upper Boat and Ebbw Vale: Uprating of 132 kV 1,500 MVA circuit breakers.—Metropolitan-Vickers Electrical Co.

Iver—West Weybridge—Melksham: 275 kV twin 0.4 sq in double circuit overhead lines.—Balfour Beatty & Co.

Variation of Areas

Part of the parish of Eckington, Derbyshire, including a housing estate at Gleadless and the site of an estate at Base Green, has been transferred from the area of the East Midlands Electricity Board to that of the Yorkshire Electricity Board. To give effect to this variation the Minister of Fuel and Power has made the Electricity (Area) (Gleadless and Base Green) Order, 1953 (S.I. 1953 No. 679, H.M. Stationery Office, price 2d).

North of Scotland Board Finance

The Treasury has issued a statement of guarantees given during the year ended 31st March last under the Hydro-Electric Development (Scotland) Acts, 1943 and 1952, and the Electricity Act, 1947. Guarantees were given on various dates in respect of temporary borrowings by the North of Scotland Hydro-Electric Board amounting in the aggregate to £46 million and in respect of stock amounting to £40 million.

Regent Street Coronation Lighting

Giant Tudor Rose lighting fittings, made in "Chrysaline" by the General Electric Co., Ltd., are being erected on building fronts in Regent Street. One thousand of these specially designed G.E.C. Coronation lighting fittings

A general view of the Coronation lighting fittings being mounted on building fronts in Regent Street

illuminated from within and made in two sizes (5ft and 3ft in diameter) will be situated at more or less regular intervals, at first floor levels. The whole operation is expected to take three weeks.

Floodlighting at Chatsworth

Chatsworth, the Duke of Devonshire's mansion in Derbyshire, now has a complete floodlighting installation. The floodlit grounds and gardens are open to the public from 2nd to 17th May. Philips "Altrilux" 500 W internal reflector lamps are used. Fourteen of these lamps are used below the surface in illuminating the fountains, and a further fifty to give external light to the fountains and arcade, and in the rose garden and some of the avenues. Altogether 282 lamps are used.

Chatsworth, the Duke of Devonshire's mansion, Derbyshire, at night

Freedom of Choice

Subject to no capital contribution being required by the South Western Electricity Board, St. Thomas (Devon) R.D.C. has agreed to provide electric cooker circuits and control panels in houses on its Lympstone estate. The first tenant of each house will be allowed to choose either a gas or an electric cooker, which will be provided by the Council.

Power Station Water Supply

An indication of a start in the next few months on the new £15,000,000 power station at Blyth (Northumberland) is given in a report to Tynemouth Corporation. The British Electricity Authority has asked Tynemouth Corporation Water Department for a water supply amounting to 85,000 gallons daily for the power station by the middle of next year. By 1963 the demand will have increased to 500,000 gallons a day. The Corporation is to guarantee this amount of water.

Scottish Distribution Scheme

The North of Scotland Hydro-Electric Board's Strichen distribution scheme, under which electricity will be supplied to 2,400 farms and 2,000 other premises in an area of about 450 square miles, embracing most of Aberdeenshire and part of Banffshire outside of Macduff, was formally inaugurated on 22nd April. The ceremony took place at Burnt Smithy, on the Turiff–Banff road, two miles north of Turiff, where Mrs. Mackie, wife of Mr. Maitland Mackie, chairman of the North of Scotland College of Agriculture, started up the automatic pile driver and crane for placing the first pile in position. Mr. Tom Johnston, chairman of the Board, said that out of 2,785 farmers and crofters, 1,888 had so far agreed to take an electricity supply. The cost was as low as it was for any agricultural area in Britain—indeed lower than in most areas, despite the longer distances in transmission. Obviously, if a number of consumers in the area took only a very small supply the transmission charges would be heavy and unfair to other consumers. So they were asking for a minimum consumption of £3 worth of electricity per room for seven years. Comparing the fuel costs which the people were paying for similar services Mr. Johnston contended that the average was 7s per week against their guaranteed cost (for a four-roomed cottage) of 4s 7d per week. The scheme, estimated to cost £1,000,000, will take between four and five years to complete.

Bradford Street Lighting Policy

The principal regional officer of the Ministry of Housing has drawn the attention of the BRADFORD Corporation to the apparent high capital cost of street lighting schemes for the Moorside, Allerton and Buttershaw "C" housing estates. He has asked the City Council to consider whether the proposed standard of sodium lighting is essential and whether it would not be cheaper to obtain competitive tenders instead of having the work undertaken by the Yorkshire Electricity Board. The Street Lighting Sub-Committee is of the opinion, however, that the present system whereby the Board does all the Corporation's street lighting installations on agreed terms is favourable to the Corporation, and has requested a joint meeting in order to point out the advantages.

Corn Exchange Rewiring

Maidstone Market Committee is considering a scheme for the complete rewiring of the Corn Exchange, together with the installation of fluorescent lighting fittings.

Manx Farm Electrification

The Isle of Man Electricity Board has prepared a scheme for supplying electricity to a further 133 farms at a cost of £107,167. It is proposed to carry out part of the work in the current financial year.

Financial Section

STOCKS and SHARES

GILT-EDGED securities continue to be the best favoured section in the Stock Exchange. The strength of this market can be judged from the smoothness with which the new issue of £125 million 4¼ per cent British Electricity stock is being absorbed: its price has moved up from a small discount to a minute fraction over par. Industrials are distinctly off-colour. Few electrical equipment shares, however, show changes of much significance. In the heavy engineering group, Babcock & Wilcox were lowered to 67s 9d after the publication of the figures for the year and the final dividend, which again makes a total of 18 per cent.

Bakelite Debentures

Dealings began last Monday in the £1 million 5 per cent debenture stock offered publicly at 100 by Bakelite, Ltd. The issue has been made with the object of replacing temporary borrowing and of completing the financing of the new Durham factory. It will be repaid finally at 100 in 1977, or earlier at various premiums from 1968 onwards. According to the prospectus, the principal amount of the loan is covered nearly four times by the net assets of the group, and the annual interest requirements more than ten times by the average profits of the past three years. To these figures the statement adds a report of improving business during recent weeks. Stock will be available free of transfer stamp in initial dealings and will help to meet an increasingly pressing demand for securities of this character. The price opened at ½ premium and rapidly rose to 2⅞ premium.

Company News

McMichael Radio report an improvement of about 10 per cent in the profits for 1952 and are making the seventh successive distribution of 8 per cent on the 5s ordinary shares. The latter are quoted at about 3s 6d to yield over 11 per cent. Telephone & General Trust shares have been active at around 35s under the influence of further wild swings in the price of Telephone Properties shares, which rose from 90s to 106s in the course of a single morning last week, and later moved erratically around £5¼. At 5, the price was 10s higher on the week.

E.P.L. Cases

Although most of the market activity created by the tax concessions in the Budget has subsided, the coming abolition of the excess profits levy remains very much a factor in investment calculations. Among this year's annual reports it is becoming almost a commonplace to see an expansion of trading profits converted into a reduction in the net surplus after tax, the damage being done as often as not by a substantial liability for E.P.L. As noted here before, this levy is by itself costing some companies more than, or nearly as much as, the net amounts distributed for last year in dividends, so that its eventual disappearance seems bound to react more favourably on some concerns than on others.

Taxes and Dividends

One of the situations to attract market attention in connection with the coming abolition of the excess profits levy appears in the accounts published last month by the Telegraph Condenser Company. In this case, a useful advance in the 1952 trading profit was more than offset by larger tax liabilities. These included an amount of £78,000 for E.P.L., whereas little more than £30,000 net was distributed in dividends. Other instances of companies which have incurred a heavy E.P.L. penalty for their progress include Brook Motors, who show a charge of £30,000 under that heading for a period covering only nine months of its incidence, as compared with £50,000 paid in dividends. Plessey's liability for only six months exceeded the year's dividends, and Dubilier Condenser's tax position also looked a particularly hard case.

Watford Electric

A yield of over 7 per cent is shown on the 2s ordinary shares of the Watford Electric & Manufacturing Co., which published its annual report last month and is making a total distribution of 25 per cent for the third year running. Trading profits were a record in the company's history. The net surplus, after tax, is only slightly higher, E.P.L. having come into operation to the extent of nearly £12,000, a sum equal almost exactly to the net amount distributed as ordinary dividend. The latter appears to be covered nearly twice by the distributable profit. The shares are quoted at 7 .

Laurence, Scott

The 5s shares of Laurence, Scott & Electromotors have remained at about 14s 3d since the announcement, at the end of last month, of a single dividend of 15 per cent for 1952 on the "A" and "B" ordinary shares. The dividend is at the rate to which it was raised

from 12½ per cent, a year ago and evidently represents a careful distribution of the surplus available. For the sixth year in succession, the company reports a substantial advance in trading profits. They have expanded on this occasion by the best part of £100,000, so that although tax charges (including £54,000 for E.P.L.) have risen concurrently by some £79,000, the net figure is still well up at £185,000. The ordinary dividends involve the distribution of £33,000 net. A "rights" issue of new shares on a one-for-ten held basis is proposed.

Company	Dividend Previous	Dividend Last	Middle Price 4th May 1953	Week's Rise or Fall	Est. Yield p.c.
Gilt-edged and Overseas Stocks			£ s d		
Brit. Elec. 1968/73	3	3	88	—	3 8 2
Brit. Elec. 1974/77	3	3	86½	—	3 9 4
Brit. Elec. 1976/79	3½	3½	92	—	3 16 1
Brit. Elec. 1974/79	4½	4½	100½	—	4 4 6
Calcutta Elec. ..	6†	6†	20/6	—	5 17 0†
East African Power	7	7	23/-	—	6 1 8
Nigerian Elec. ..	10	10	22/6	—	8 18 0
Palestine Elec. "A"	5†	Nil	13/6	—	—
Perak Hydro-Elec.	Nil	Nil	15/-	—	Nil
Equipment and Manufacturing					
AberdareCables(5/-)	20	25	15/6	+6d	8 1 3
Aerialite (1/-) ..	83⅓	88⅓	9/3	−3d	9 11 0
Allen, W. H. ..	15	15	46/3	—	—
Aron Elec. Ord. ..	15	15	38/9	—	7 14 10
Assoc. Elec. Ord...	20	20	80/-	—	5 0 0*
Automatic Tel. & El.	15	15	62/6	−6d	4 16 0
Babcock & Wilcox	18	18	67/9	−4/9	5 6 4
Baldwin, H. J.(2/-)	25	20	4/-	—	10 0 0
Bakelite (10/-) ..	—	12½	17/-	—	7 7 0
British Aluminium	12	12	39/-	−6d	6 3 0
B.I. Callender's ..	9	10	37/6	—	5 6 8
British Thermostat (5/-)	30	30	31/3	−½	4 16 0
British Vac. Cleaner (5/-)	25	25	14/-	—	8 18 8
Brook Motors (10/-)	20	20	33/9	—	5 18 6
Brush Ord. (5/-) ..	10	4	4/3	—	—
A. F. Bulgin (1/-)..	30	30	2/9	—	10 18 0
Burco (5/-) ..	38¾	35	18/9	—	9 6 8
Chloride El. Storage	15	20	69/-	−1/-	5 16 0
Cole, E. K. (5/-) ..	25	25*	17/-	−6d	—
Cossor, A. C. (5/-)..	Nil	10	9/6	−6d	5 5 3
Crabtree (10/-) ..	17½	17½	31/-	−3d	5 13 0
Crompton Parkinson Ord. (5/-) ..	11¼	11¼	9/9	—	5 15 5
De La Rue (5/-) ..	50	35*	7/6	−6d	—
Decca (5/-) ..	112½	150	25/-	−1/-	6 0 0*
Dewhurst (2/-) ..	22½	19*	5/6	+3d	6 18 3
Dictograph Tel. (2/-)	20	20	6/6	—	6 3 0
E.M.I. (10/-) ..	12	12	13/-	−3d	9 4 9
Electrical Components (5/-) ..	20	20	10/-	—	10 0 0
Elec. Construction	15	15	55/-	—	5 9 0
Enfield Cable Ord.	7½	5	21/6	−6d	4 13 0
English Electric ..	15	15	58/-	—	5 3 6
Ericsson Tel. (5/-)	22½	22*†	40/-	+6d	2 15 0†
Ever Ready (5/-)	35	35	28/6	—	6 2 9
Edk Stadelmann..	15	15	43/3	—	6 18 9
G.E.C. Ord. ..	22½	22½	41/3	−⅛	5 9 1*
General Cables (5/-)	30	30	16/3	—	9 4 6
Greenwood & Batley	15	15	40/-	—	7 10 0
Hackbridge Cable (5/-)	20	20	12/-	—	8 6 8
Hackbridge Hewittic (5/-)	18	20	16/3	—	6 3 0
Hall Tel. Acc. (10/-)	10	10	11/3	−6d	8 17 10
Heatrae (2/-) ..	12½	12½	4/-	—	6 5 0
Henleys (10/-) ..	20	20	19/-	+6d	5 5 3*
Holophane (5/-) ..	15	20*	12/6	—	8 0 0
Hoover (5/-) ..	35	25	23/-	—	5 8 0

Company	Dividend Previous	Dividend Last	Middle Price 4th May 1953	Week's Rise or Fall	Est. Yield p.c.
Equipment and Manufacturing (continued)			£ s d		
Intl. Combustion (5/-)	25	15*	14/3	+3d	5 5 3
Johnson & Phillips	15	15	51/-	—	5 17 9
Lancashire Dynamo	12½	12½*	46/3	—	5 8 0
Laurence, Scott (5/-)	12½	15	14/3	—	5 5 3
London Elec. Wire	12½	12½	57/6	−9d	4 7 0
J. Lucas	7½	9½	40/-	−⅛	4 11 8
Marryat & S. (2/-)	22½	22½	5/9	—	7 16 6
Mather & Platt ..	12½	15	49/6	—	6 1 3
Metal Industries ..	10	15	43/6	−⅛	—
Mid. Elec. Mfg. ..	15	15	60/9	—	4 18 9
Murex	12½	15	60/-	—	5 0 0
Newman Ind. (2/-)	10	10	2 4½	—	8 8 5
Oldham & Son (1/-)	30	35	2/6	—	—
Parnall (Yate) (5/-)	6	6	3/3	−1½d	9 4 8
Parsons, C. A. ..	10*	12½	68/9	+⅛	3 12 8
Plessey (5/-) ..	22½	25	23/6	−1/-	5 6 3
Pye Deferred (5/-)	18	18	19/6	—	4 12 4
Revo (10/-) ..	27½	27½	46/-	—	5 19 7
Reyrolle	10*	12½	56/3	−⅛	4 8 8
Scot. Cable (1/-) ..	30	32	12/9	−3d	—
Siemens Ord. ..	10	10	35/6	—	5 12 9
Southern Areas ..	Nil	5	12/9	—	7 16 10
Strand Elec. (5/-)..	17½	17½	10/-	−6d	8 15 0
Sturtevant (5/-) ..	17½†	18¾*†	25/3	−6d	3 11 9*†
Switchgear&Cowans (5/-)	22½	22½	14/9	−1/6	7 12 7
Taylor T. (5/-) ..	20	25	20/-	—	6 5 0
T.C.C. (10/-) ..	20	20*	41/3	—	4 17 0
T.C. & M. ..	10	8½*	28/-	—	6 1 6
Telephone Mfg.(5/-)	10	10*	8/9	—	5 14 3
Thorn. Elec. (5/-)..	10	12½	10/-	—	6 5 0
Tube Investments	25	15*	60/-	—	5 0 0
Vactric (5/-) ..	Nil	Nil	5/-	—	Nil
Veritys (5/-) ..	7½	10	5/-	—	10 0 0
Walsall Conduits (4/-)	70	70	46/-	−6d	—
Ward & Goldstone (5/-)	45	45*	35/-	—	—
Watford (2/-) ..	25	25	7/-	—	7 2 10
Westinghouse Brake	14	15	53/9	—	5 11 6
West, Allen (5/-)..	15	15	12/6	+3d	6 0 0
Trusts, Transport and Communications					
Anglo-Am. Tel.: A Ord. ..	—	6	89½	—	6 14 0
Ord.	—	3½	54½	—	6 17 6
Anglo-Portuguese	8	8	23/3	+1/-	6 17 9
Brit. Elec. Traction: Def. Ord. ..	22½	25	520	+5	4 15 9
Cable & Wireless: Ord.	8	8	134	+1	5 19 5
4% Loan ..	4	4	95	—	4 4 3
Calcutta Trams ..	6†	6†	22/9	—	5 5 6†
Cape Elec. Trams..	5	5½	11/6	—	9 11 4
Marconi Marine ..	10	10	30/6	—	6 11 2
Oriental Tel. Ord.	16	16	72/-	—	—
Telephone Props...	8	8	100/-	+10/-	—
Tele. Rentals (5/-)	10	10	10/-	+3d	5 0 0

* After capital bonus. † Dividends are paid free of Income Tax.

REPORTS and DIVIDENDS

The Brush Electrical Engineering Co., Ltd.—The annual meeting will be held on 21st May. In his statement, which has been circulated with the report and accounts, Sir Ronald W. Matthews (chairman) says that their electrical engineering factory at Loughborough has had a reasonably successful year. The diesel engine factories, however, have had certain setbacks. They have had to finance from internal sources and bank borrowings a heavy increase in stocks which were sold but of which customers were either unable to take immediate delivery owing to import restrictions or for which they were unable to make immediate payment through currency or financial restrictions. Their Staines and Leeds factories were most seriously affected. At Stockport there has been a drop in output during the change-over from the old HF and TL engines to the modern J and K range, but this operation has now been successfully completed.

It is in regard to Associated Tube Wells, Ltd., that they have had their most serious problems. The first contracts have not proved entirely satisfactory, largely because the prices agreed in 1950 proved inadequate in the face of rising costs and in the early stages they experienced some difficulty in settling certain technical and procedural problems with the Indian Provinces for which the work was being carried out. They have had to provide a substantial sum towards the losses already experienced on these first contracts. There is now a large organization with skill, experience and equipment to enable future tubewell projects to be tackled efficiently and to the benefit of the group and a further contract has been undertaken on more favourable terms. Up to the middle of March last 526 wells had been drilled and handed over to the Provincial Governments and 122 more are in varying stages of completion. The closing months of 1952 were more profitable than the spring and the summer.

The 1½ million volt surge laboratory has been officially opened by Sir Ben Lockspeiser and they have thus extended their transformer test facilities to deal with the new 275 kV limit established by the super-grid and at some later date with the 400 kV range which is being investigated in other countries. Brush Coachwork, Ltd., has reduced production in order that space and labour may be made available for electrical equipment. Manufacture of public transport vehicles and caravans has ceased, although production of battery vehicles continues on a satisfactory scale. Sir Ronald reviews some of the more important orders received and carried out by the group.

Babcock & Wilcox, Ltd., in a preliminary statement, shows a group profit, after all charges, including £3,259,320 for taxation, of £1,418,449 for 1952, as compared with £2,076,718 for the previous year. General reserve receives £600,000 and research and development reserve £100,000. It is proposed to pay a final ordinary dividend of 7½ per cent, and a bonus of 3 per cent, maintaining the distribution for the year at 18 per cent.

Glenfield & Kennedy, Ltd., report group profits for 1952, before taxation, of £998,777, as compared with £1,177,174 for 1951, and after providing £707,379 for taxation, and making other deductions, there is a net balance of £213,541 (against £315,062). Reserves receive £100,000 and it is proposed to pay an ordinary dividend for the year of 15 per cent (same, plus 2½ per cent centenary bonus). The balance carried forward is £91,056 (against £83,134).

The Watford Electric & Manufacturing Co., Ltd., made a trading profit for 1952 of £87,719, as compared with £60,935 for the preceding year, and after meeting all charges, including £59,857 for taxation, there is a net balance of £24,475 (against £23,600). It is proposed to pay a final dividend of 10 per cent and a bonus of 10 per cent, again making 25 per cent for the year. The balance carried forward is £91,708 (against £82,225 brought in).

Sangamo Weston, Ltd., reports a balance from trading account for 1952 of £217,408, as compared with £128,057 for the preceding year. After meeting all charges, including £79,447 for taxation, there is a net profit of £71,996 (against £33,167). The dividend for the year is unchanged at 12½ per cent, and the balance carried forward is £414,570 (against £363,246 brought in).

Laurence, Scott & Electromotors, Ltd., earned trading profits for 1952 of £593,281, an increase of £98,384 as compared with 1951; the net profit was £185,313 (against £168,707). Taxation absorbed £307,000. The dividend for the year on the "A" and "B" ordinary is unchanged at 15 per cent. A rights issue of one "A" ordinary share at par for every ten ordinary shares held is to be made to "A" and "B" ordinary shareholders.

W. Canning & Co., Ltd., announce a net profit for 1952, after deducting £215,418 for taxation, of £181,534, as compared with £163,262 for the previous year. The dividend for the year is unchanged at 35 per cent, by a final payment of 25 per cent.

The Anglo-Portuguese Telephone Co., Ltd., reports a net profit for 1952 of £127,864, as compared with £117,642 for 1951. The final ordinary dividend is 5 per cent, making

8 per cent for the year (same) on increased capital. The dividend for the year on the "A" ordinary is also maintained at 8 per cent. The balance carried forward is increased by £2,502 to £77,314.

McMichael Radio, Ltd., reports a net profit for 1952 of £24,273 (against £22,186 for 1951). The dividend for the year is unchanged at 8 per cent.

Burco, Ltd., has announced an interim dividend of 5 per cent (against 10 per cent).

New Companies

Danebury Electric, Ltd.—Registered 7th April. Capital £2,000. Manufacturers of and dealers in electrical and mechanical apparatus and accessories, etc. Directors: C. W. Hatton and Mrs. Hilda B. Hatton. Regd. office: 31, Hambledon Road, Boscombe East, Bournemouth, Hants.

Smith & Cookson (Domestic), Ltd.—Registered 31st March. Capital £100. Selling agents for Smith & Cookson, Ltd., and to carry on the business of merchants, importers and exporters of and dealers in electrical, wireless and television goods, etc. H. Cookson is the first director. Regd. office: 106/8, Whitechapel, Liverpool, 1.

Smith & Cookson (Electrical), Ltd.—Registered 31st March. Capital £100. T. Armstrong is the first director. The objects and other particulars (except director) are similar to those of Smith & Cookson (Domestic), Ltd.

Smith & Cookson (Radio), Ltd.—Registered 31st March. Capital £100. H. A. Smith is the first director. The objects and other particulars (except director) are similar to those of Smith & Cookson (Domestic), Ltd.

Morgan, Evans & Sweeney, Ltd.—Registered 9th April. Capital £3,000. Manufacturers of and dealers in all types of electrical signs, neon light signs and all kinds of electrical equipment, etc. Directors: W. S. Evans, W. H. Morgan and R. H. Sweeney. Solicitors: Collins & Co., Swansea.

Television Hire Service (Yorks), Ltd.—Registered 19th March. Capital £10,000. To acquire the business of hirers of television apparatus carried on by W. B. R. D. Machin and W. Wilson at Green Hammerton, Yorks. Directors: W. B. R. D. Machin and W. Wilson. Solicitors: Wells & Hind, 14/16, Fletcher Gate, Nottingham.

E. J. Benton, Ltd.—Registered 11th April. Capital £10,000. Designers and manufacturers of and dealers in electrical, electronic, radio, television and telephone apparatus, sets and supplies, etc. Directors: E. J. Benton, M. McDonald and Molly D. Benton. Regd. office: 164, High Street, Lye, Stourbridge.

Bankruptcies

H. Bullock, trading as H. Bullock & Sons, at 17, High Street, Bromyard, Herefordshire, electrical engineer.—Receiving order made 28th April on debtor's own petition.

R. H. Bullough, trading as Hyson Radio, 72, Gregory Boulevard, Nottingham, radio, electrical and cycle dealer.—Last day for receiving proofs for dividend, 20th May. Trustee, Mr. E. C. Stimpson, 22, Regent Street, Park Row, Nottingham, Official Receiver.

E. J. R. Tremlett, 941, Wimborne Road, Moordown, Bournemouth, radio and electrical dealer.—Last day for receiving proofs for dividend 21st May. Trustee, Mr. C. S. Dawson, Midland Assurance Building, Fir Vale Road, Bournemouth.

B. F. Robbings, lately carrying on business at 1388, Greenford Road, Greenford Green, Middx, under the style of "Electric House," radio and electrical retailer, and at 81a, Northolt Road, South Harrow.—Last day for receiving proofs for dividend 12th May. Trustee, Mr. W. J. Wallis-Hill, 3, Central Buildings, Matthew Parker Street, Westminster, London, S.W.1, Official Receiver.

J. H. Coupland, residing and carrying on business at 85, Northgate, Canterbury, under the style of E. J. Ratcliff, electrical engineer.—First and final dividend of 1s 0½d in the £, payable at the Official Receiver's office, 1, The Parade, Canterbury.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 22nd May.

POSSER-MATIC. No. 715,148. Class 7. Washing machines, machines for attaching to washing and the like boilers for converting such boilers into washing machines; suction pumps; and parts included in Class 7 for all these goods.—L. G. Hawkins & Co., Ltd., 30–35 Drury Lane, Kingsway, London, W.C.2.

ELLA. No. 709,122. Class 9. Electrical measuring instruments.—Lionel Robinson & Co., Ltd., 3, Staple Inn, London, W.C.1.

PHAIR. No. 709,531. Class 9. Electric accumulators, batteries, cells, and parts included in Class 9 of all the aforesaid goods.—Société de la Pile Leclanche, Chasseneuil-du-Poitou (Vienne), France. Address for service, c/o Marks & Clerk, 57 & 58, Lincoln's Inn Fields, London W.C.2.

CONOGRAPH. No. 713,164. Class 9. Electric and electronic apparatus and instruments, all included in Class 9; radio, television, telephone, cinematographic and signalling instruments; sound recording, sound reproducing and sound transmitting apparatus and instruments; parts included in Class 9 of all the aforesaid goods; and gramophone needles, gramophone records, phonograph rolls, and cinematograph films prepared for exhibition.—G. Kingsley, trading as Dictating Machine Co., and also as Conograph Dictating Machine Co., 32, Victoria Street, London, S.W.1.

AEROSEAL. No. B713,808. Class 11. Electric fans, being parts of ventilating systems.—Burke & Son, Ltd., 69, High Street, Belfast.

NEXT WEEK'S EVENTS

Monday, 11th May

DUNDEE.—Mathers Hotel, 7.30 p.m. Incorporated Plant Engineers, Dundee Branch. "Textile Machinery," by R. Baird.

LONDON.—St. Ermin's Hotel, Caxton Street, S.W.1, 6.45 p.m. A.S.E.E. Central London Branch. "Development of Clocks," by G. W. Levey.

Monday, 11th May, to Friday, 15th May

CLACTON.—Town Hall. Electrical Trades Union. Annual conference.

Monday, 11th May, to Saturday, 16th May

LONDON.—New Horticultural Halls. Glass Industries Exhibition.

Tuesday, 12th May

BELFAST.—Presbyterian Hostel, Howard Street, 6.15 p.m. I.E.E. Northern Ireland Centre. Annual general meeting.

BIRMINGHAM.—Grand Hotel, 7 p.m. Institution of Works Managers, Birmingham Branch. Annual general meeting.

BRISTOL.—Electricity House, 7 p.m. I.E.E. Bristol Students' Section. Annual general meeting, followed by a film show.

GLOUCESTER.—M.E.B. Service Centre, Eastgate Street, 7.30 p.m. Purchasing Officers' Association, Gloucestershire Branch. Annual general meeting.

HIGH WYCOMBE.—Red Lion Hotel, 7.30 p.m. Purchasing Officers' Association, Oxon and Bucks Group. Talk by Mr. F. B. Rose, followed by the second annual general meeting.

LIVERPOOL.—Electricity Board's Service Centre, 6 p.m. I.E.S. Liverpool Centre. Annual general meeting. "The Electrical Equipment of the Mersey Tunnel," by C. C. Smith.

LONDON.—Royal Society of Arts, John Adam Street, W.C.2, 6 p.m. Illuminating Engineering Society. Annual general meeting. An address on "Lighting in Australia and Europe," by D. C. B. Maclurcan.

Wednesday, 13th May

BIRMINGHAM.—James Watt Institute, 6.45 p.m. I.E.E. South Midland Students' Section. Annual general meeting.

BRADFORD.—Midland Hotel, 7.30 p.m. A.S.E.E. Bradford Branch. "Air Conditioning," by J. Rose.

LONDON.—Savoy Place, 5.30 p.m. I.E.E. Radio Section. "Recent Work in France on New Types of Valve for the Highest Radio Frequencies," by Dr. R. Warnecke and Monsieur P. Guenard.

Cafe Royal, 6.30 for 7 p.m. Illuminating Engineering Society. Annual dinner.

NEWCASTLE-UPON-TYNE.—Crown Hotel, Clayton Street, 7 p.m. Purchasing Officers' Association, Tyneside Branch. Annual general meeting.

NOTTINGHAM.—Welbeck Hotel, 7 p.m. Incorporated Plant Engineers, East Midlands Branch. "Industrial Applications to the Thickness Gauge," by R. Y. Parry.

STAFFORD.—Swan Hotel, 7.15 p.m. Purchasing Officers' Association, Wolverhampton Branch. Annual general meeting, preceded by lunch.

Thursday, 14th May

LONDON.—Savoy Place, W.C.2, 5.30 p.m. Institution of Electrical Engineers. Annual general meeting.

NEWCASTLE-UPON-TYNE.—Roadway House, Oxford Street, 7.30 p.m. Incorporated Plant Engineers, Newcastle-upon-Tyne Branch. "Electrical Fuel Injection Equipment Applicable to Heavy Goods Vehicles and Contractors Plant," by H. J. Stoneman.

Friday, 15th May

NOTTINGHAM.—E.M.E.B., Smithy Row, 6 p.m. I.E.S. Nottingham Centre. Annual general meeting.

Friday, 15th May, to Monday, 18th May

WOOLACOMBE.—Woolacombe Bay Hotel. I.E.E. Western Centre. Summer meeting.

Saturday, 16th May

LONDON.—Women's Engineering Society, London Branch. Visit to Hurstmonceux Observatory.

FRENCH ELECTRICAL TRADE

IN spite of a big home demand for electrical equipment, France last year imported rather less and exported slightly more than in 1951. The value of imports totalled 17,500 million francs compared with 18,000 million in 1951, and that of exports 45,500 million against 43,000 million francs. Of the total exports 16,500 million francs represented sales in foreign countries and 29,000 million sales in overseas France. (988 fr = £1.)

Generating plant to the value of 6,500 million francs constituted over a third of the imports, 15 per cent less than in 1951. Radio apparatus was bought from abroad to the value of 1,600 million francs against 1,150 million in 1951. Principal suppliers of generating plant were Italy, United States, Switzerland, Germany and Belgium–Luxemburg and of radio apparatus United States, Holland and the United Kingdom.

Exports of generating plant to foreign countries amounted in value to 3,800 million francs and to overseas France 6,300 million, in each case rather more than in the previous year, while those of radio apparatus increased by about 25 per cent with a total of 3,700 million francs to foreign destinations and 2,600 million francs to overseas France. Another leading export was the wire and cable group aggregating 5,800 million francs—rather above the 1951 figure—with overseas France the main customer.

Chief foreign customers for French generating plant were Spain, Belgium–Luxemburg, Holland, West Germany, Brazil and Portugal; for radio material, Egypt, Sweden, Lebanon, Uruguay and Mexico; and for cables Sweden, Belgium, Greece and Italy.

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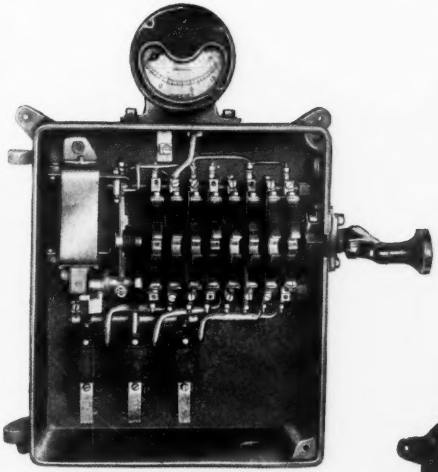

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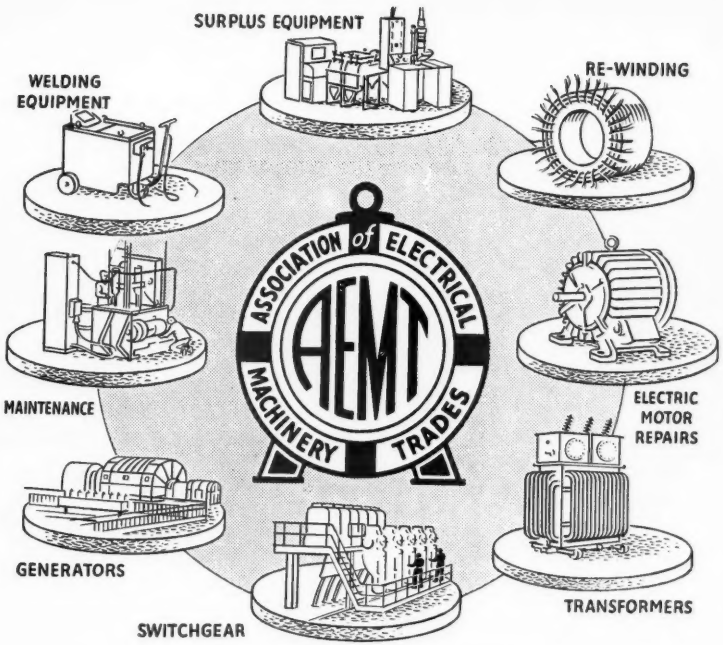

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By courtesy of J. R. Radington-Meech, Chairman and Managing Director, Burdette & Co. Ltd.

The new Wythenshawe factory of the Insuloid Manufacturing Co., Ltd.

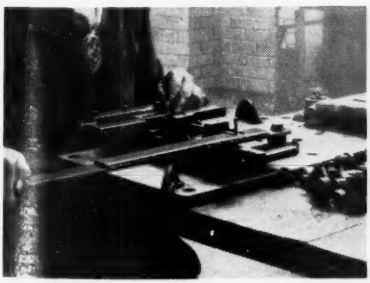
Insulated Installation Accessories

Production at a New Manchester Factory

TO meet the increasing demand for its products and permit the development of a number of new lines the Insuloid Manufacturing Co., Ltd., has recently opened a new factory in Leestone Road, Wythenshawe, Manchester. The company is gradually transferring its production to the new works from its two other factories which it is proposed ultimately to close down. Initially the new factory has a floor area of 4,000 sq ft but provision is made for eventual extension up to 15,000 sq ft.

At the moment the company is best known for its application to busbars, etc., of a cellulose acetate or hardened p.v.c. coating either by shrinking it on the material in tube form or by spraying. The spraying method is normally adopted for irregularly shaped articles for which the shrinking method is unsuitable. Both materials have very high electrical breakdown properties. They do not deteriorate and are claimed to outlive the apparatus in which they are used.

A process in the manufacture of insulated cable clips



Of equally promising possibilities, however, are two more recent developments: insulated cable clips and " Ring Lock " cable bushes. The cable clips, which are made from plastic material, besides being suitable for interior and exterior electrical installation work generally, are specially applicable to electrical instrument and radio and television apparatus manufacture. The clips are strong, resilient, rustproof, weatherproof, rotproof and of high insulation value. Electrolysis cannot take place at the fixing points.

The " Ring Lock " bush, which has been designed to protect cables passing through metal partitions, panels, etc., consists of a shaped plastic sleeve and an elastic locking ring. It can be assembled by unskilled labour without tools in a few seconds and once fitted cannot work loose or become detached by vibration. It is extremely difficult to remove without the aid of special tools. No tapping or countersinking of the hole in the metal is required. The bush is impervious to water, oil, petrol, acid or exacting climatic conditions and can be used in temperatures between — 40 deg C and 100 deg C.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 17th June from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1947

16433. Cork, E. C., and Bowman-Manifold, M.—Vertically arranged electric wave feeders of the screened conductor type. 4th June, 1948. (692851.)

1948

5123. Continental Carbon, Inc.—Production of electrical resistors. 20th February, 1948. (692921.)

33191. Williams, F. C., Robinson, A. A., and Kilburn, T.—Circuit arrangements for addition of binary numbers. 10th December, 1949. (692853.)

1949

17246. Lincoln Electric Co., and Arnold, J. C. (Lincoln Electric Co.).—Arc welding flux composition and methods of using same. 29th June, 1949. Addition to 691527. Convention date not granted. (692772.)

18524. Cuny, A.—Emergency electrical generating sets. 13th July, 1949. (692994.)

25049. National Research Development Corporation.—Lighting fittings using fluorescent tubular amps. 22nd September, 1950. (692775.)

31674. Standard Telephones & Cables, Ltd.—Electrical measuring instruments. 8th December, 1950. (692780.)

1950

1722. Leithäuser, G.—Gas discharge lamp for recording acoustic vibrations. 23rd January, 1950. (692998.)

2630. Automatic Electric Laboratories, Inc.—Telephone systems. 1st February, 1950. (692999.)

4140. Standard Telephones & Cables, Ltd.—Radio direction finders. 9th February, 1951. (692990.)

6438. Donovan Electrical Co., Ltd.—Fuse carriers for electric fuses. 14th March, 1951. (693004.)

15068. Kelvin & Hughes, Ltd.—Remote repeater or indicating apparatus. 30th May, 1951. (693008.)

18989. Sonnenfeld, H.—Electric power cable. 26th June, 1951. (693010.)

19200. British Thomson-Houston Co., Ltd., and Maggs, A. H.—Dynamo-electric machines. 2nd July, 1951. (693011.)

20688. Electric Construction Co., Ltd.—Automatic paralleling systems for alternators. 15th August, 1951. (692939.)

21041. Standard Telephones & Cables, Ltd.—Electric trigger circuits. 17th August, 1951. (692802.)

24746. Electro-Mecanique de l'Aveyron.—Electric brakes. 10th October, 1950. (692807.)

26028. Automatic Electric Laboratories, Inc.—Electronic translator for automatic telephone systems. 25th October, 1950. (693014.)

27826. English Electric Co., Ltd.—Electric motor control systems. 9th November, 1951. (692811.)

27975. Marconi's Wireless Telegraph Co., Ltd.—Landing approach navigation aiding radio systems. 20th September, 1951. (692812.)

28839. General Electric Co., Ltd., and Rycroft, J. L.—Electric heaters. 13th November, 1951. (692883.)

30737. Ferranti, Ltd.—Electromagnetic relays for regulating the voltage of a d.c. circuit. 17th December, 1951. Addition to 585064. (692887.)

31531. National Research Development Corporation.—Screened chassis for the mounting of components in the construction of electronic equipment. 31st December, 1951. (693016.)

1951

495. Electric Storage Battery Co.—Alloys for use in electric storage batteries. 8th January, 1951. (692820.)

562. Carr Fastener Co., Ltd.—Holders for electrical terminals adapted to be connected with electrical lead wires. 7th December, 1951. Cognate application 899, 17th April, 1951. (692821.)

2602. Marbourn, Ltd.—Electric socket couplings and combined electric switches and socket couplings. 24th January, 1952. (693019.)

3189. Gibson Refrigerator Co.—Electric ranges. 9th February, 1951. (692828.)

4515/6 & 4680. Sylvania Electric Products, Inc.—Fixtures for electric lamps. 23rd February, 1951. (692959-61.)

5663. General Motors Corporation.—Electrical switch control mechanisms. 8th March, 1951. Addition to 580287. (692893.)

5772. British Insulated Callender's Cables, Ltd.—Electric measuring apparatus of the bridge type working with alternating currents. 7th March, 1952. (692894.)

13000. Licentia Patent-Verwaltungs Ges.—Electric measuring set. 31st May, 1951. (692837.)

17512. Standard Telephones & Cables, Ltd.—Electron discharge devices. 24th July, 1951. (692841.)

22414. Durepaire, M. A. J. L., and Springer, B. A. K.—Production of sealed joints for example for electric condenser casings. 25th September, 1951. (692844.)

24064. Allmanna Svenska Elektriska Aktiebolag.—Method for producing wound magnetic cores having approximately circular cross-section. 16th October, 1951. (692845.)

27538. British Thomson-Houston Co., Ltd.—Photo-cell angle response compensators. 23rd November, 1951. (692913.)

1952

1246. Bosch Ges., R.—Production of commutators. 16th January, 1952. (692974.)

3750. Corning Glass Works.—Manufacture of electrical condensers. 12th February, 1952. (692975.)

6838. British Thomson-Houston Co., Ltd.—Spacer members for electrical coils. 17th March, 1952. (692976.)

7359. British Thomson-Houston Co., Ltd.—Weft straighteners. 21st March, 1952. (692981.)

7380. Standard Telephones & Cables, Ltd.—Method of mounting an electric condenser or other electric component in a metal case and condenser assembly according to that method. 21st March, 1952. (692982.)

7396. Soc. Alsacienne de Constructions Mecaniques.—Methods and devices for decoding groups of coded electric pulses representing a signalling wave. 21st March, 1952. (692983.)

7539. Edison Swan Electric Co., Ltd.—Sweep voltage generators. 24th March, 1952. (692984.)

7732. Westinghouse Electric International Co.—X-ray apparatus. 26th March, 1952. (692985.)

7915. Ultra Electric, Ltd.—Collapsible aerials. 27th March, 1952. (692987.)

11810. Electro-Mecanique de l'Aveyron.—Electric brakes. 10th October, 1950. Divided out of 692807. (692849.)

28297. Electric Construction Co., Ltd.—Automatic paralleling systems for alternators. 15th August, 1951. Divided out of 692939. (692989.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Alnwick (Northumberland). — R.D.C. Electrical installations in 14 houses at Craster. Reavell & Cahill, architects, Lloyds Bank Chambers, Alnwick.

Australia. — BRISBANE. — 8th July. State Electricity Commission of Queensland. L.v. switchgear for the Townsville Regional Electricity Board. (C.R.E. 14872/53. Ten/6232.)* 19th August. Supply of materials, clearing of route and erection of 132 kV overhead transmission line. (See this issue.)

12th June. Brisbane City Council. Six rotary test meters. (C.R.E. 14873/53. Ten/6250.)*

SYDNEY.—2nd July. County Council. Supply of l.v. switchboards for substations. (C.R.E. 13921/53. Ten/6225.)*

Belfast. — 19th June. — Electricity Department. 110 kV and 33 kV main cables, auxiliary cables and accessories. (See this issue.)

Bushey.—1st June. U.D.C. Street lighting equipment. (See this issue.)

Colne Valley.—29th May. U.D.C. Street lighting equipment. (See this issue.)

Ealing.—Corporation. An approved list of firms who will be invited to tender for the lighting of Western Avenue, Greenford, is being prepared. (See this issue.)

Farnworth.—25th May. Corporation. Electrical installations in 189 houses. (See this issue.)

Gateshead.—10th June. Corporation. Electrical installation at Dryden Road Grammar School. (See this issue.)

India.—NEW DELHI.—20th May. Director of Supplies and Disposals. Batteries, negative and positive plates, cells, separators, etc. (C.R.E. 15115/53. Ten/6283.)* 27th May. Train lighting dynamos. (C.R.E. 15242 & 15249/53. Ten/6268 & 6266.)* 15th June. Lead acid cells. (C.R.E. 15245/53. Ten/6273.)*

Leeds.—15th June. Regional Hospital Board. Electrical installations in new nurses' hostels. (See this issue.)

London.—22nd May. India Store Department. Radio kits. (See this issue.)

North Riding. — Education Committee. Electrical installations at Catterick Camp branch library and at Eston Grammar and Technical School. D. W. Dickenson, school architect, County Hall, Northallerton.

Pakistan.—KARACHI.—15th May. Posts and Telegraphs Department. Supply of insulators, wires and wiring materials. (C.R.E. 13958/53. Ten/6239.)* 20th May. Telephone cables and accessories. (C.R.E. 13956/53. Ten/6240.)*

26th May. Director General, Department of Supply and Development. Supply of accumulators. (C.R.E. 14813/53. Ten/6238.)* 30th May. Electric cables, wires, and cable boxes. (C.R.E. 15289/53. Ten/6275.)*

South Africa.—JOHANNESBURG.—18th May. City Stores and Buying Branch. Supply of twenty traction motor commutators. (C.R.E. 15595/53. Ten/6285.)*

21st May. Union Tender and Supplies Board. Supply of radio spares and accessories. (C.R.E. 15157/53. Ten/6260.)*

21st May. Chief Stores Superintendent, South African Railways. Supply of thirty-seven electric motor driven forge fans. (C.R.E. 14789/53. Ten/6248.)*

Southgate.—18th May. Borough Council. Supply of lanterns and control gear for 134 140 W sodium vapour discharge lamps; and for thirty-five 250 W mercury vapour lamps. Borough surveyor, Town Hall, Palmers Green, N.13.

Sunderland.—18th May. Town Council. Electrical installation at Hylton Red House Junior School. Borough architect, Grange House, Stockton Road.

Worcester.—19th May. City Council. Electrical installation at the Guildhall. (See this issue.)

*Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Horse Guards Avenue, Whitehall, S.W.1 (Trafalgar 8855).

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Boreham Wood.—Church hall; Welch & Lander, architects, 38, Gloucester Place, W.1.

Boston. — Gynasium at Boston Grammar School (£18,720); county architect, Boston.

Bredbury and Romiley. — Public hall (£30,000); U.D.C. surveyor.

Brighton.—Terraced houses (11), Essex and Bedford Streets; borough surveyor, Town Hall.

Dwellings (62), Craven Vale estate; James Miller & Partners, Ltd.

Factories, Hollingbury area, for Henry Clark & Sons, Ltd. (ships' compositions and marine paint), and Lower Bevendean area for "Elizabeth English" Shoes, Ltd.; town clerk.

Factory (No. 3) for Underwood, Elliott & Fisher, Ltd., Hollingbury area; Frank Eve, 19, Cottenham Park Road, Wimbledon, S.W.20.

Chester.—Showroom, St. Werburgh's Street; Lotus & Delta, Ltd., 43, New Bond Street, W.1.

Chesterfield. — Houses, Pevensey estate; borough architect.

Crawley.—Shops, Three Bridges Centre (11) and Langley Green Centre (20); chief architect to Development Corporation, Broadfield, Crawley, Sussex.

Croydon.—Works extensions; Chapman & Co., Ltd., Canterbury Mills, Canterbury Road.

Dover.—Houses (42), Aycliffe; J. A. Johnson, town clerk, New Bridge House.

Durham.—Pithead baths, medical centre and canteen at Tursdale Colliery; N.C.B. Architects' Department, Ashfield Towers, Gosforth, Newcastle-on-Tyne.

Hastings.—Modern school for boys at The Grove, St. Leonards; borough surveyor, 37, Wellington Square.

Hoole.—Flats (20), Hoole House estate; R. Boot, architect to U.D.C., 22, Newgate Street, Chester.

Hove.—County infants' school; county architect, County Hall, Lewes.

Huddersfield.—C. of E. School, Lindley; John Radcliffe & Sons, Ltd., St. John's Road.

Hyde.—Houses (100), Dukinfield Road estate; borough engineer.

Fabricating bay and canteen; Hatchett & Co., Ltd., Kingston Works.

Jarrow-on-Tyne.—Bus station for Northern General Transport Co., Ltd.; Fennell & Co., architects, Bridge End Chambers, Chester-le-Street.

Kingsclere.—Houses (66), Hetheralls; R.D.C. surveyor, Council Offices, Kingsclere, near Newbury, Berks.

Kingston-on-Thames.—Sewage works and pumping station, Hogsmill Valley; John Taylor & Sons, consulting engineers, Artillery House, S.W.1.

Leamington Spa.—Shops and flats, Whitnash estate; Rayner & Fedeski, architects, 28, Parade.

Leeds.—Rayon technology buildings; Leeds University authorities.

London.—LEWISHAM.—R.C. secondary school, Belmont Hill; Westminster R.C. Diocese, Cathedral House, S.W.1.

MERTON ABBEY.—Works extensions; Hadfields, Ltd., Phipps Bridge Road, S.W.19.

WESTMINSTER. — Flats (114), Section 2 of Churchill Gardens, for City Council; Gee, Walker & Slater, Ltd., builders, 100, Park Lane, W.1.

Manchester.—Extensions at Little Green Works, Collyhurst, for Packing Materials Association, Ltd.; Frederick Hill, architect, 14, Manchester Road, Bury.

Middlesbrough.—Three-storey flats, Langridge Crescent; borough engineer.

Conversion of premises at Parkside, The Avenue and Clairville Road into old people's flats (£16,900); borough engineer, Municipal Buildings.

Newcastle-on-Tyne. — Offices, Osborne Terrace, for National Dock Labour Board; C. S. Errington, architect, 46, Grainger Street.

North Acton.—Factory, Park Royal Road and Standard Road; Sant-Sturgess, Ltd., 9/11, Standard Road, N.W.10.

Orrell (Lancs).—Houses (54), Kitt Green estate; P. Ashurst, clerk to U.D.C., Orrell, near Wigan.

Portsmouth. — Dwellings (112), Newbolt Road; E. Figgins & Sons, 33, Drayton Lane, Cosham.

Rotherham.—Showrooms and offices; West Riding Motor Co. (Rotherham), Ltd., Sheffield Road.

Rowley Regis.—Houses (166), Tividale; borough surveyor, Municipal Buildings, Old Hill, Cradley Heath, Staffs.

Salford.—Eight-storey flats; city engineer.

Scarborough.—Houses (34), Wreyfield Drive, Barrowcliff; borough engineer.

Stafford.—Flats, Rising Brook estate; G. A. Poole, Ltd., Newcastle-under-Lyme.

Stockport.—Flats (44), Brinnington estate; borough surveyor.

Stone.—Maisonnettes (24) for aged, Lichfield Road site; U.D.C. surveyor.

Sunderland.—Garage extensions for Northern General Transport Co., Ltd., Gateshead; A. H. Fennell & Co., architects, Bridge End Chambers, Chester-le-Street, Co. Durham.

Tenterden.—Houses (34), North Street estate, Biddenden; J. M. Delves, clerk, Rural Council Offices, Halden House, High Halden, near Ashford, Kent.

Thirsk.—County grammar school; county architect, County Hall, Northallerton.

Tilbury.—Flats, houses and shops, Dock area; E. R. Collister, architect, 67, London Road, Chelmsford.

Tottenham.—Flats (30), High Road; borough engineer.

Walton-on-Thames. — Flats (60), Sydney Road; U.D.C. surveyor.

Ware.—Houses (28), Standon, for R.D.C.; surveyor, 97, New Road, Ware, Herts.

Warlingham.—Library, Mill House site, for U.D.C.; P. E. Dimmock, clerk, Council Offices, Caterham, Surrey.

Watford.—Factory premises, North Orbital Road; Printers-Heaters, Ltd., 228, Preston Road, Wembley.

Wellesbourne (Warwick). — Farm building, laboratories, canteen, glasshouses and staff houses, National Vegetable Research Station; chief engineer.

Wellingborough.—Garage, workshops and stores, Newton Road, Little Irchester; H. V. Sheffield, surveyor, Oxford Street.

West Hartlepool.—Extension of Tunstall Court Technical College; borough architect.

Weymouth.—Flats (24), and old people's bungalows (14), Downclose estate; borough surveyor, 6, Pulteney Buildings.